Driving Urban Transitions

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DREAMS

Driving Equitable and Accessible 15 Minute Neighbourhood Transformations

WP2. Review and comparative analysis

T2.3. Understanding and benchmarking the existing travel and destination selection behaviours

Deliverable 2.3

Understanding and benchmarking the existing travel and destination selection behaviours

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1. EXECUTIVE SUMMARY

The 15-minute city concept aims to provide "enhanced" accessibility to all essential services and daily needs for the entire population through the use of active travel modes, and to improve the sustainability, quality of life, and overall health of the population. The concept is on the agenda of many cities around the world, but there are major knowledge gaps in finding successful and efficient ways to implement the concept outside the urban core. The DREAMS project aims to address these knowledge gaps by investigating how mobility services, mobility hubs and flexible activity hubs (pop-up stores) can contribute to the creation of accessible, sustainable and inclusive 15-minute neighbourhoods in the urban outskirts of six European cities and regions. One of the sub-objectives of the DREAMS project is to provide a thorough understanding of the 15-minute city lifestyles and accessibility needs of different population groups in Vienna, Utrecht, Brussels, Budapest, Île-de-France and Munich. This deliverable (D2.3) presents the results of a comprehensive and comparative analysis of the 15mC lifestyles and travel needs of people living in the study areas.

The analysis results show that Utrecht and Munich have the best accessibility for shopping trips, with over 80% of trips completed within 15 minutes in both the city and the Living Lab areas. Île-de-France has the best accessibility for education trips, especially in the urban core, with almost 90% of trips completed within 15 minutes. Budapest has the lowest accessibility for work and shopping trips, especially in the outskirts. While Munich is unique in that work, shopping and leisure accessibility improves in the suburbs, making it an exception to the general trend of urban cores having better accessibility than the outskirts. Moreover, the results indicate a high degree of car dependency in the suburbs for everyday trips and especially for shopping trips, which underlines the need to improve suburban accessibility to all kinds of essential facilities.

2. INTRODUCTION

The project "Driving Equitable and Accessible 15-Minute Neighbourhood Transformations" (DREAMS) (https://www.dreams15mc.eu/) is funded as part of the Driving Urban Transitions partnership (DUT). The project aims to examine how co-created and user-centric mobility services, mobility hubs and flexible activity hubs can contribute to accessible, sustainable and inclusive 15-minute neighbourhoods in urban outskirts in European cities and regions. DREAMS is organised around seven work packages: WP1) Project and data management and quality control, WP2) Review and comparative analysis, WP3) 15-minute city decision support tool, WP4) New governance and business models and transition pathways, WP5) 15mC living labs, WP6) Impact assessment and evaluation and WP7) policy integration and recommendations, transferability and knowledge dissemination.

This document is the third deliverable (D2.3) of DREAMS WP2, entitled "Benchmarking travel and activity location choice behaviour across study locations". It presents the results of the comparative data analysis conducted to benchmark and develop the basic understanding of existing travel patterns and behaviours in all Living Lab locations (Vienna, Utrecht, Brussels, Paris, Budapest, and Munich). The comparative data analysis conducted in this report has used data from the national household travel surveys of the six European cities/regions studied. The results provide a wealth of information on modal split, trip duration and distance for four trip purpose categories (work, education, shopping and leisure) that are closely related to the 15-minute city concept. In addition to providing information on the current travel behavior of the inhabitants of the cities and Living Labs and on the level of compliance with the 15-minute city concept, this report is also intended to serve as a basis for assessing the impact of potential policy interventions related to the 15-minute city concept on the travel behavior of individuals.

The deliverables produced in WP2 (D2.1, D2.2, and D2.3) serve as the fundamental knowledge development of the DREAMS project, as they include a comprehensive literature review to revisit the definition of the 15mC (D2.1), a map of the existing planning and governance practices and business frameworks (D2.2), and a comparative data analysis of travel patterns and time use of residents in all Living Lab locations (D2.3).

The remainder of the report is structured as follows: Section 3 provides a detailed description of the steps that were followed prior to the analysis, it offers an overview of the datasets, andelucidates the analysis method. Sections 4 to 9 present the analysis results for each of the Living Lab locations. Finally, Section 10 provides a comparison of the results at both the city and outskirts levels, while Section 11 presents the conclusions drawn from the analysis.

3. METHODOLOGY

For the comparative data analysis, we used the existing household travel surveys from all the Living Lab (LL) locations. Each LL had access to at least one household travel survey dataset. To gain a clearer understanding of the scope and content of these surveys, a structured questionnaire was developed (Appendix H). This questionnaire helped in collecting all the relevant details and selecting the most suitable dataset for the analysis. The specific information we sought to gather included the following:

1. General information about the survey (e.g. name, year, sample size, description of the purpose)
2. Dataset information (e.g. availability restrictions, format type, language)
3. Information about the attributes of households and people
4. Information about the attributes of each reported trip

After collecting and evaluating the relevant information from all, available to use, household travel surveys, we selected the datasets presented in Table 1 for the analysis. Table 2 provides an overview of the dataset characteristics and variables.

Table 1: Household travel survey selection

Country/Region	Travel Survey
Austria	Österreich Unterwegs 2013-14 (ÖU)
Netherlands	Onderweg in Nederland 2021-22 (ODiN)
Brussels	Onderzoek Verplaatsingsgedrag 2021-22 (OVG)
Budapest	Household Survey for Unified Macroscopic Transport Model 2019
Île-de-France	Enquête Globale Transport 2018-20 (EGT)
Germany	Mobilität in Deutschland 2017 (MiD)

The goal of the comparative analysis, as previously outlined in this document, is to assess and enhance the understanding of current travel patterns and behaviors among individuals living in the LL locations. Therefore, the analysis focused on the travel behaviour of individuals in their local environment. Accordingly, a specific methodology has been implemented. Each database has been filtered to match with the following criteria:

1. All the reported trips have as origin the residential district of the respondent.
2. All the reported trips have as destination the same country, to avoid long trips that could influence the final output of the analysis.
3. The purpose of the reported trips is work, education, shopping, and leisure. The selection is based on the priorities set out in the 15-minute-city concept and identified in Deliverable 2.1 (1). However, Deliverable 2.1 identifies 6 core functions called: work, commerce (here, shopping), education, healthcare and services. As not all datasets include trips from the healthcare category, and trips related to services cannot be accurately identified, these two trip purpose categories are not included in the analysis.
4. The travel mode of the reported trips is pedestrian, bicycle, car (driver or passenger), or public transport.

The criteria were shaped based on the mutual characteristics of the datasets in use. As illustrated in Table 2, it becomes evident that the aggregation level of the resident region of the respondents varies across the datasets. Consequently, the district level was selected as it is consistent across all datasets. It is noteworthy that the Austrian and German national household datasets are the most outdated; however, they were the only available datasets for analysis, thus necessitating their use. With regard to socioeconomic-related variables on individual level, it is observed that the Brussels dataset does not include a substantial number of variables pertinent to the analysis. Finally, in the Budapest dataset, the trip duration and distance variables were not included, and thus, they had to be calculated for the analysis. The trip duration variable was successfully calculated using the recorded start and end times of the trip; however, the trip distance variable could not be calculated due to an absence of relevant data. A more thorough exposition of the data analysis characteristics of each city can be found in the following sections.

Table 2: Overview of the national household travel survey characteristics and variables

	Austria	The Netherlands	Brussels	Budapest	Île-de-France	Germany
A. General Information						
Name	Österreich Unterwegs (ÖU)	Onderweg in Nederland (ODiN)	Onderzoek Verplaatsingsgedrag (OVG)	Household survey for Unified Macroscopic Transport model	Enquête Globale Transport 2020 (EGT H2020)	Mobilität in Deutschland (MiD)
Year	2013-2014	2021-2022	2021-2022	2019	2018-2020	2017
Number of reported days per respondent	2	1	1	1	1	1
Type of reported days	All the days	All the days	All the days	Weekdays	Weekdays	All the days
Survey period	October 2013– December 2014	January 2021 – December 2021	March 2021 – January 2022	October – November 2019	January 2018 – March 2020	May 2016 – October 2017
Net sample size	17.070 Households – 38.220 Individuals	48.000 Individuals	2.685 Individuals	4800 Households in Budapest, 120 households in Agglomeration	4.800 Households, 10.470 Individuals	156.420 Households, 316.361 Individuals
Survey area	Austria	The Netherlands	Brussels Capital Region	Budapest and Agglomeration	Île-de-France	Germany
Definition of reported trip	Every trip that uses the public space/network	Individual report on activity for the requested day	-	Door to door by addresses for every trips during one workday	Individual report of all trips made during the day before the interview	All trips made by the members of a household through the reported day
Aggregation level	District (Bezirk)	Postal code	Postal code	District & Address	Couronne/ District	Address, Postal code, Municipality, District
B. Household Characteristics						
Living Location	✓	✓	✓	✓	✓	✓
Size	✓	✓	✓	✓	✓	✓
Composition	✓	✓	-	✓	✓	-
Income	✓	✓	-	✓	✓	✓
Num. and type of private transport means	✓	✓	✓	✓	✓	✓
C. Individuals Characteristics						
Age	✓	✓	✓	✓	✓	✓
Gender	✓	✓	✓	✓	✓	✓
Academic level	✓	✓	-	✓	✓	✓
Occupation	✓	✓	-	✓	✓	✓
Income	✓	✓	-	✓	✓	-
PT Subscriptions	✓	✓	-	✓	✓	✓
Driving licence	✓	✓	-	✓	✓	✓
Available means of transport	✓	✓	-	✓	✓	✓

Total travel distance per person	✓	✓	-	-	-	-
Total travel time per person	✓	✓	-	-	✓	-
D. Trips Characteristics						
Aggregation level of origin and destination	Postal code, Municipality, District	Postal code	Postal code	Address	Couronne/ District	Address, Postal code, Municipality, District
Trip purpose						
Work	✓	✓	✓	✓	✓	✓
Business trip	✓	✓	✓	✓	✓	✓
School/Education	✓	✓	✓	✓	✓	✓
Dropping off/picking up/accompanying people	✓	✓	✓	✓	✓	✓
Shopping	✓	✓	✓	✓	✓	✓
Running errands	✓	✓	✓	✓	✓	✓
Leisure	✓	✓	✓	✓	✓	✓
Visiting friends	✓	✓	✓	✓	✓	-
Other	-	Recreational walking	Recreational walking	-	-	-
Trip mode	✓	✓	✓	✓	✓	✓
Trip length	✓	✓	✓	-	✓	✓
Trip duration	✓	✓	✓	-	✓	✓

4. VIENNA

4.1.General characteristics of Vienna and LL location

Vienna is the capital and one of the nine federal states of Austria and consists of 23 districts (“Bezirke”). With more than 2 million inhabitants in 2024, it is the largest city in Austria and one of the fastest growing major cities in Europe (2). Vienna has an extensive public transport infrastructure consisting of 6 underground lines, railway, suburban railway, tram, bus and bicycle infrastructure. It also offers car and micromobility sharing services.

The Viennese Living Lab is Wiener Flur and its surrounding neighbourhoods, which are located in the 23rd District of Vienna, known as "Liesing". Liesing is situated in the south-west of Vienna and has a population of approximately 118.000 inhabitants. Wiener Flur is proximate to the border of Lower Austria and constitutes the largest public housing development in the former village of Siebenhirten in Liesing. The area is served by the U6 underground line, a tram line, bus lines and car/bike sharing services.

Figure 1 shows the map of Vienna and the location of the Viennese Living Lab “Wiener Flur” (red pin).

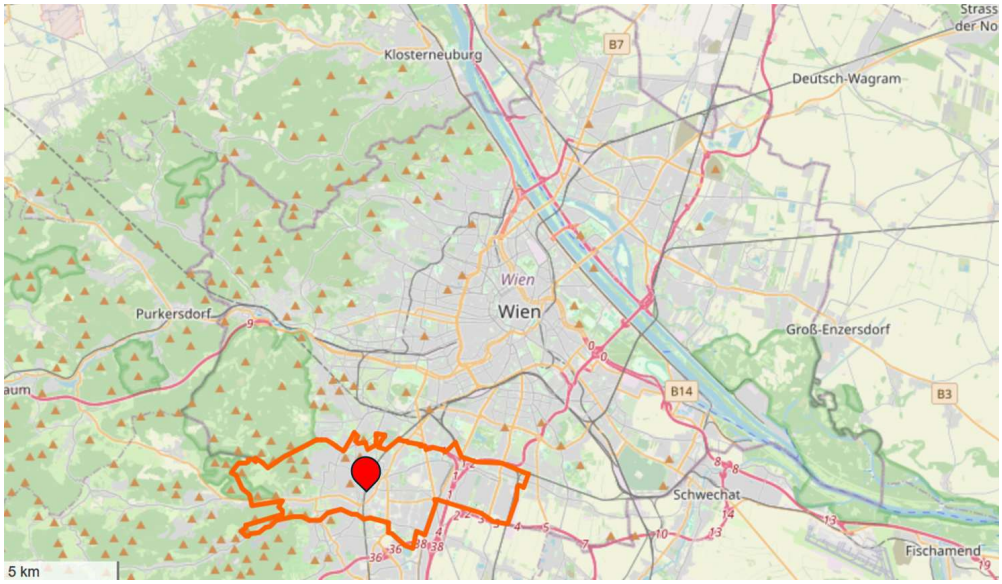


Figure 1: Location of the Liesing district (orange line) and the Vienna Living Lab (red pin) (Source: OSM (2024))

4.2.Descriptive statistical analysis

The analysis begins with an overview of the socioeconomic characteristics of households and individuals. A short list of variables has been selected from the dataset "Österreich Unterwegs 2013/14" (2), to help us picture and understand the characteristics of residents, both at the city level and at the district level of the Living Lab location. Table 3 shows the socioeconomic characteristics of households, while Table 4 outlines the socioeconomic characteristics of individuals.

It should be noted that the information on the respondent's place of residence is provided by the dataset ÖU at the district level (Bezirke), and therefore for the case of the LL location "Wiener Flur" we analyse the whole area of Liesing. The sample used for this part of the analysis is the *total resident population* within the area (Vienna or Liesing), with no filtering for specific trip purposes. Furthermore, the sample of survey respondents who did not provide a valid response to one or more of the selected questions was excluded from the sample.

Table 3: Socioeconomic characteristics of households (Vienna & Liesing) – Source: ÖU 2013/14

Socioeconomic Characteristics of Households

	Vienna		LL Location (Liesing)	
	n	**%**	**n**	**%**
Household size				
1 Person	970	31.9	52	27.4
2 Persons	1230	40.4	79	41.6
3 Persons	446	14.6	22	11.6
4+ Persons	399	13.1	37	19.5
Economic situation (Self estimation of respondents)				
Very poor	43	1.5	2	1.1
Poor	183	6.2	5	2.7
Average	1334	45.1	95	51.1
Good	1089	36.8	69	37.1
Very good	307	10.4	15	8.1
Car ownership				
0	620	23.1	20	11.5
1	1594	59.5	110	63.2
2	399	14.9	39	22.4
3	57	2.1	5	2.9
4+	10	0.4	-	-

Table 4: Socioeconomic characteristics of individuals (Vienna & Liesing) - – Source: ÖU 2013/14

Socioeconomic Characteristics of Individuals

	Vienna		LL Location (Liesing)	
	n	**%**	**n**	**%**
Gender				
Male	2734	46.3	181	44.9
Female	3173	53.7	222	55.1
Age Category (y.o.)				
6 – 14	368	6.2	35	8.7
15 – 19	324	5.5	30	7.4
20 – 24	332	5.6	16	4.0
25 – 34	813	13.8	46	11.4
35 – 44	783	13.3	47	11.7
45 – 54	1060	17.9	64	15.9
55 – 64	837	14.2	56	13.9
65+	1390	23.5	109	27.0
Occupation				
Student	1011	17.1	85	21.1
Employed	2606	44.1	154	38.2
Pensioner	1650	27.9	127	31.5
Other	640	10.8	37	9.2
Car Driving License				
Yes	4256	80.9	295	84.8
No	1004	19.1	53	15.2
Availability of bike				
Yes	3195	62.5	252	71.2
No	1919	37.5	102	28.8
Availability of car				
Always	2797	57.4	222	67.3
Occasionally	806	16.5	42	12.7
Never	1272	26.1	66	20.0

The descriptive statistical analysis provides a comprehensive insight into the demographic characteristics of the residents of Vienna and Liesing. Firstly, the sample of women is slightly larger than that of men. Comparing the distribution with the official statistics (51% females in Vienna and 52% in Liesing), both for Vienna and Liesing there is only a small oversampling of women in the sample (3, 4). This demonstrates that the survey's sample represents sufficiently the actual population. Secondly, residents of Liesing have a greater availability of cars and bicycles, while slightly larger proportion of households in Liesing belong to the average income category. In addition, middle-aged and older adults, as well as people in work and retirement, are more strongly represented in the sample.

4.3.Modal split

Figure 2 illustrates the modal split by trip purpose for the city of Vienna. It is evident that Viennese citizens prefer by far the use of public transport for their educational and work trips. Regarding leisure and shopping trips, the most prevalent travel modes are walking and public transport. Car use is also popular, particularly for shopping and work-related trips, while bike use is among the least popular modes of transport for all trip purposes.

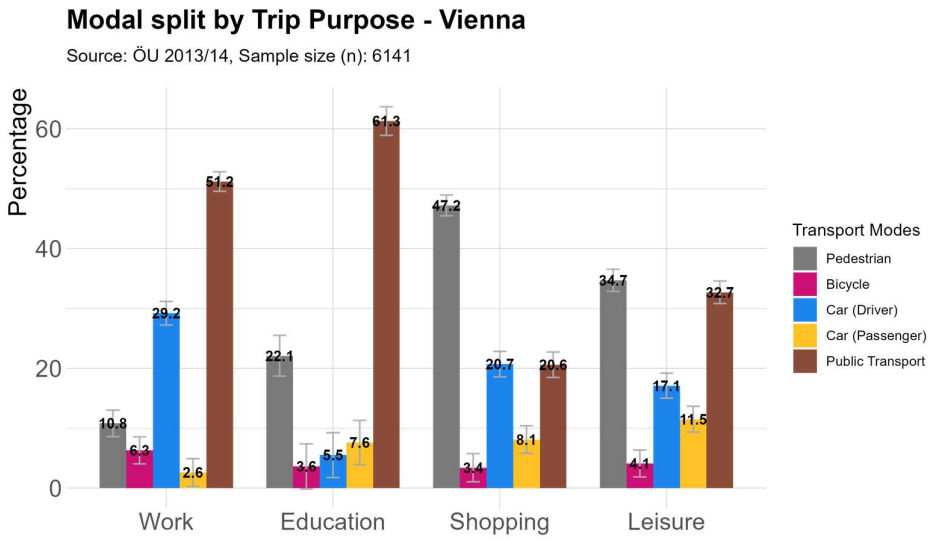


Figure 2: Modal split by trip purpose - Vienna

In Liesing, the modal split results show a preference in car use and public transport, particularly for education and work-related trips (Figure 3). However, Liesing's residents prefer to drive more than using public transport for their work commutes. This is largely due to Liesing's location on the Viennese outskirts, where the public transport network may be less extensive, and many residents work in areas outside of Liesing, which are not easily accessible by modes other than car. As for shopping-related trips, the car is also the dominant mode of transport, highlighting the lack of shopping opportunities accessible by other more sustainable modes. Bike use remains low on the list of preferences among Liesing's residents. It is important to highlight that the sample size for the area of Liesing is smaller than that of Vienna, and this may affect the representativeness of the results. This is also reflected in the error bars shown in the plots.

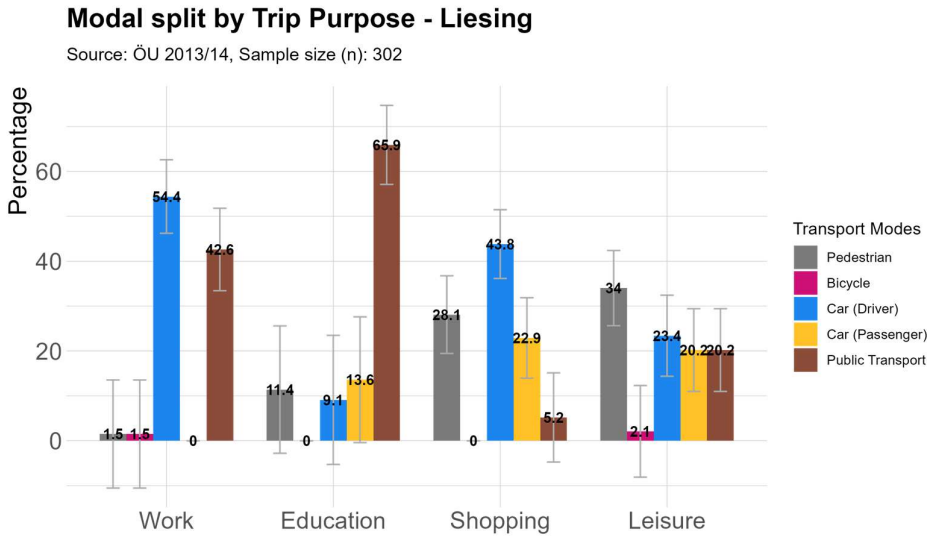


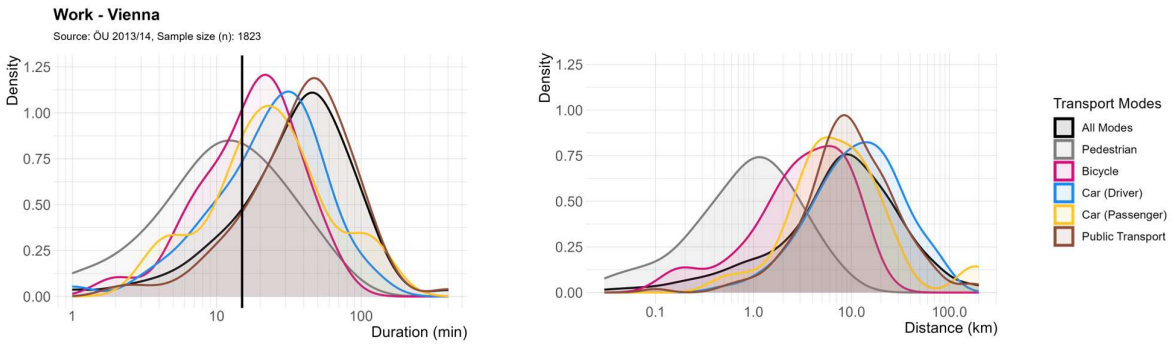
Figure 3: Modal split by trip purpose - Liesing

4.4.Trip Characteristics – Vienna

4.4.1.Work trips

The following density plots (Figure 4) illustrate the distribution of the trip duration and trip distance across the 5 different transport modes, while Table 5 presents the working trip duration and distance statistics across modes in Vienna. To gain a more comprehensive understanding of the trip characteristics, the Cumulative Distribution Function (CDF) has been calculated for both the travel distance and duration. This function enables the calculation of the percentage (%) of working trips conducted up to a certain amount of time or distance, and helps the reader understand whether or not the travel behaviour of the people living in Vienna is in line with the 15mC concept. Figure 5 illustrates the CDF functions for working trip duration and distance in Vienna.

In Vienna, the average work trip duration is approximately 30 minutes, with an average distance of almost 10 kilometres. According to Table 6 only the 27% of work trips in Vienna are completed in less than 15 minutes. The high standard deviation (SD) suggests significant variability in the sample, indicating that some trips are considerably longer or shorter than the average. Work-related trips in Vienna conducted by public transport, the most preferred travel mode of the Viennese residents for this trip purpose, have an average duration of 37 minutes while less than 10% of these trips are completed in under 15 minutes (see Table 6). Work related car trips in Vienna, either as driver or passenger, are shorter in duration than the average, although the distances covered are greater. Furthermore, more than 50% of the trips undertaken by car as a passenger lasted less than 15 minutes, while for the trips conducted as a driver this figure approaches 30%. Work related walking trips in Vienna are the shortest in both duration and distance, and more than 80% of them last up to 15 minutes.



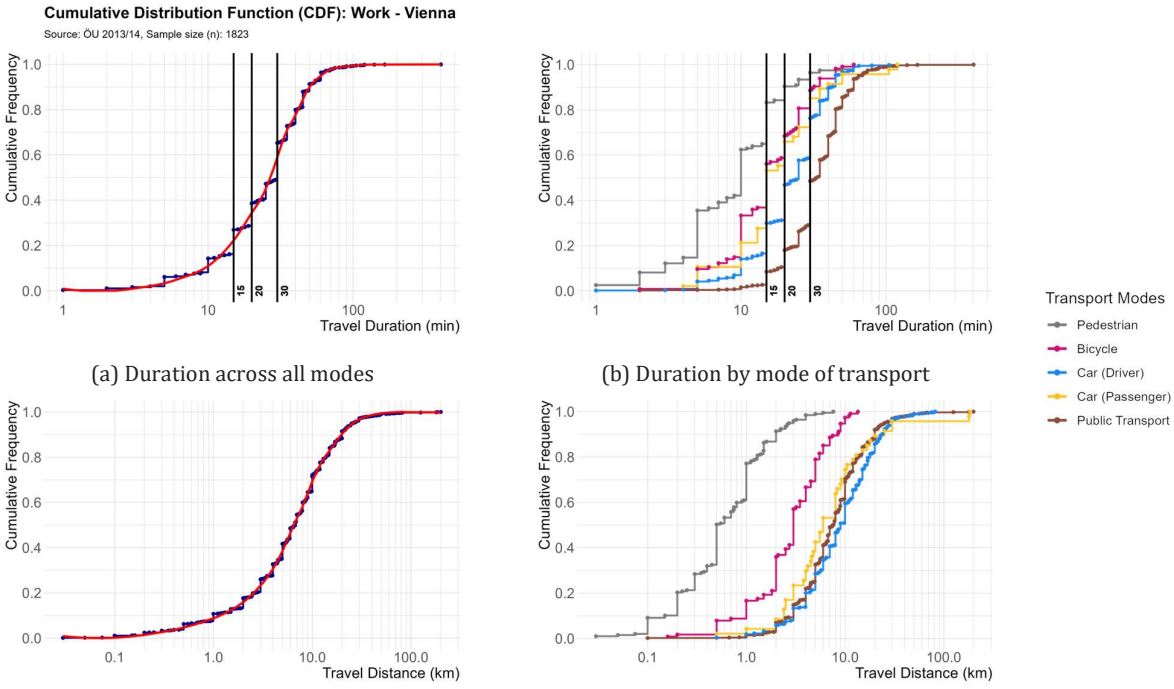
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 4: Density plot of work trip duration (a) and distance (b) by transport mode – Vienna

Table 5: Work trip statistics by transport mode - Vienna

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	1823	29.45	30.0	19.81	9.56	6.7	12.77
Pedestrians	197	11.87	10.0	10.33	0.93	0.5	1.04
Bicycle	114	18.48	15.0	11.18	3.77	3.0	2.75
Car (as Driver)	532	25.34	25.0	13.63	12.01	9.0	10.69
Car (as Passenger)	47	23.38	15.0	21.92	15.64	6.0	36.23
Public Transport	933	37.15	34.0	21.19	10.40	7.6	12.73



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

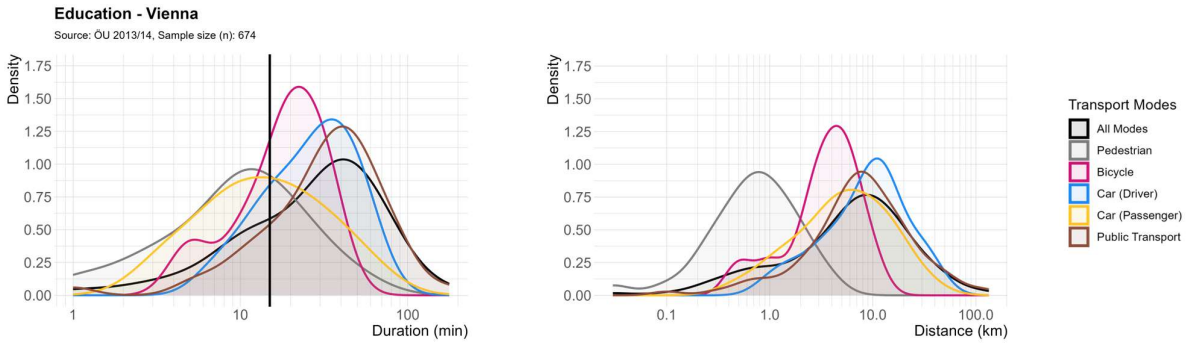
Figure 5: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Vienna

Table 6: Percentage of work trips conducted for different time stamps and modes - Vienna

Transport modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	14.3%	26.9%	38.6%	65.3%
Pedestrians	62.4%	83.2%	90.4%	96.4%
Bicycle	33.3%	56.1%	68.4%	88.6%
Car (as Driver)	14.1%	29.9%	46.8%	76.3%
Car (as Passenger)	21.2%	53.2%	65.9%	85.1%
Public Transport	1.6%	8.5%	18.0%	48.6%

4.4.2. Educational trips

According to Table 7, the average duration of an educational trip in Vienna is approximately 25 minutes, with an average distance of 6.2 kilometres. A high proportion (41%) of education trips are completed in less than 15 minutes (see Table 8). Similarly to the work-related trips, the high standard deviation (SD) of education-related trips suggests significant variability in the sample. This is due to the fact that this category includes not only trips to educational institutions but also to universities, which are mostly located in the city centre of Vienna, necessitating longer travel distances. Trips conducted by public transport, which is the most preferred mode of transport for this purpose, have an average duration of 32 minutes, while less than 20% of these trips are made in less than 15 minutes. Walking trips are also popular and are much shorter (11 minutes) than average. Moreover, more than 90% of walking trips are completed in less than 15 minutes, indicating a high level of accessibility to educational facilities.



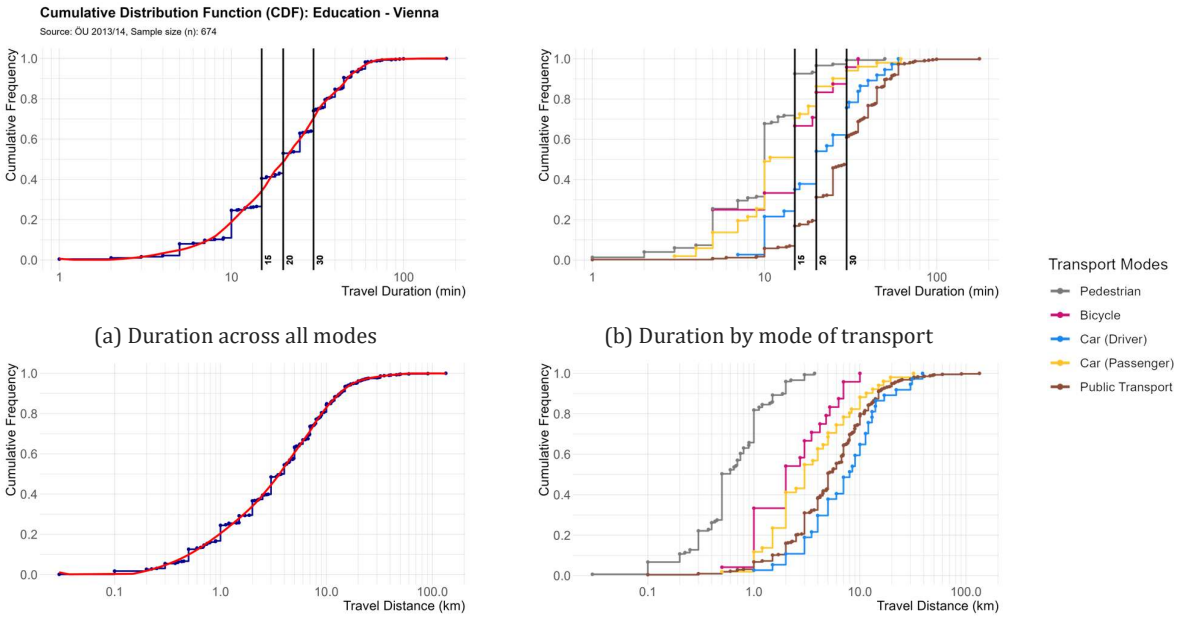
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 6: Density plot of educational trip duration (a) and distance (b) by transport mode – Vienna

Table 7: Educational trip statistics by transport mode - Vienna

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	674	24.79	20.0	17.08	6.15	3.9	9.17
Pedestrians	149	10.67	10.0	6.21	0.81	0.5	0.66
Bicycle	24	15.37	15.0	8.57	3.09	2.0	2.47
Car (as Driver)	37	24.22	20.0	13.45	9.93	8.0	8.57
Car (as Passenger)	51	14.96	10.8	10.69	5.25	3.0	5.79
Public Transport	413	31.70	30.0	17.08	8.02	5.0	10.52



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

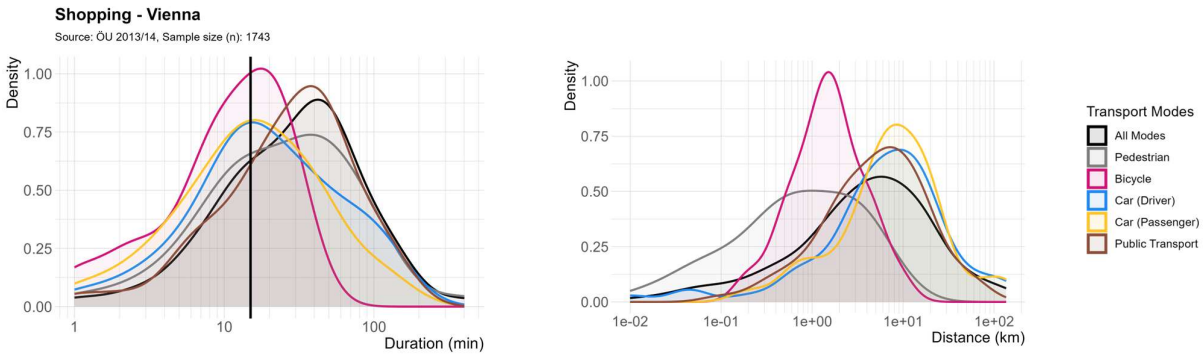
Figure 7: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Vienna

Table 8: Percentage of education trips conducted for different time stamps and modes - Vienna

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	24.6%	40.5%	53.0%	74.0%
Pedestrians	67.8%	92.6%	96.6%	99.3%
Bicycle	33.3%	66.7%	83.3%	95.8%
Car (as Driver)	21.6%	35.1%	54.1%	75.7%
Car (as Passenger)	49.0%	70.6%	86.3%	94.1%
Public Transport	5.8%	16.9%	31.2%	61.0%

4.4.3. Shopping trips

Table 9, reveals that on average Viennese citizens make short trips (16.5 minutes) to fulfil their shopping needs. According to Table 10, 70% of shopping trips are completed within 15 minutes, indicating a dense network of shopping locations across Vienna. Walking is the most common mode for shopping trips, with an average duration of 13 minutes, while more than 80% lasting up to 15 minutes. In addition, shopping trips made by car or public transport are frequent in the sample, with an average trip duration of 16 and 26 minutes respectively. It should be noted that the shopping trips included in this category are not only for daily needs but also for additional purchases, such as clothing or home equipment. This may influence the average trip duration as people may travel longer to reach bigger retail facilities.



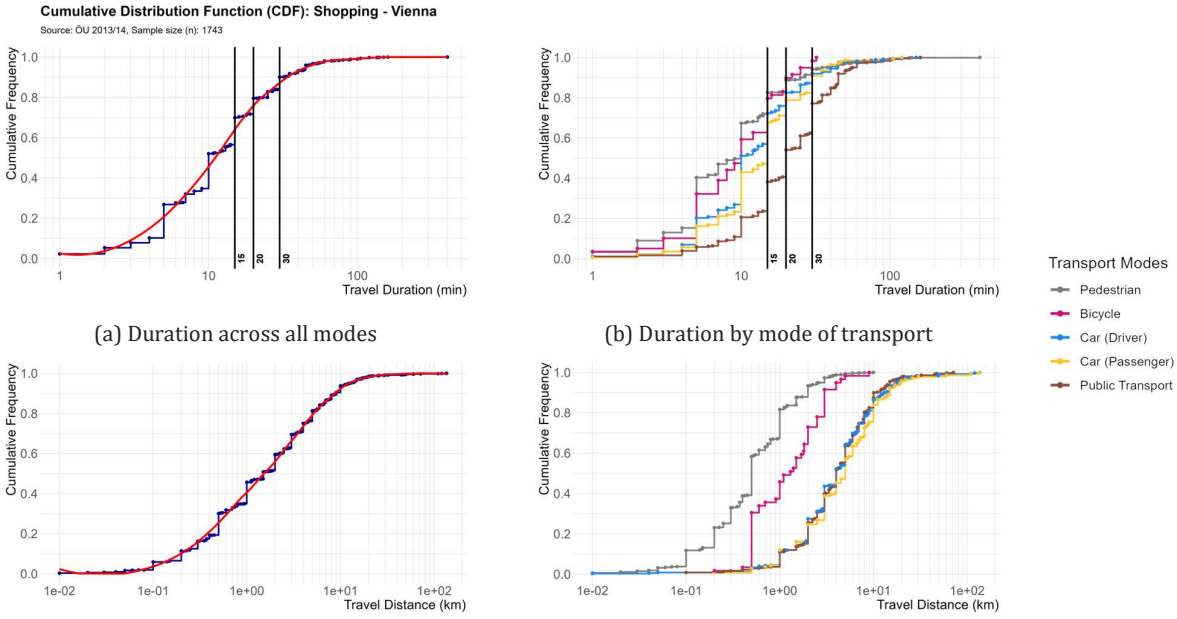
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 8: Density plot of shopping trip duration (a) and distance (b) by transport mode – Vienna

Table 9: Shopping trip statistics by transport mode - Vienna

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	1743	16.51	10.0	19.29	3.79	1.5	8.52
Pedestrians	823	12.94	10.0	20.15	0.82	0.5	0.96
Bicycle	59	11.37	10.0	7.53	1.71	1.3	1.52
Car (as Driver)	360	16.12	10.0	16.65	6.99	4.0	12.64
Car (as Passenger)	142	17.08	15.0	15.37	8.19	5.0	15.36
Public Transport	359	25.68	20.0	19.49	6.02	4.0	7.35



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

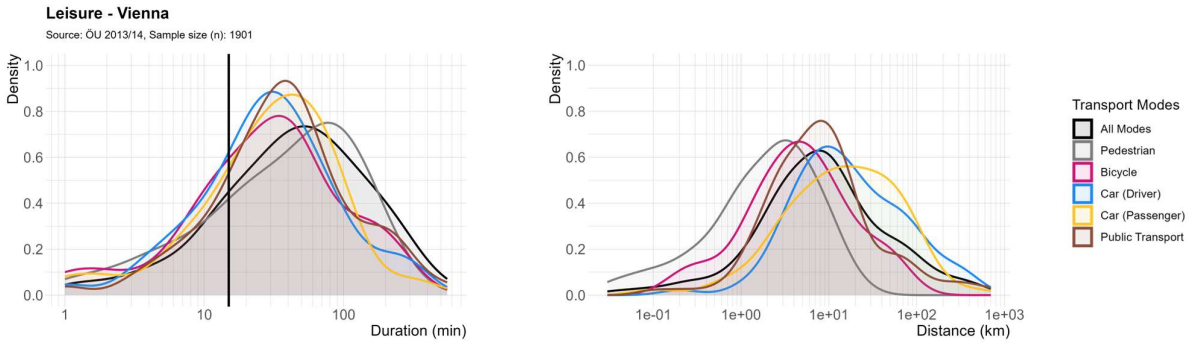
Figure 9: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Vienna

Table 10: Percentage of shopping trips conducted for different time stamps and modes - Vienna

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	52.1%	69.9%	79.5%	90.1%
Pedestrians	67.3%	82.5%	88.7%	94.2%
Bicycle	59.3%	79.7%	89.8%	98.3%
Car (as Driver)	51.1%	72.2%	82.5%	91.9%
Car (as Passenger)	43.0%	67.6%	78.9%	90.8%
Public Transport	20.6%	38.2%	54.0%	77.2%

4.4.4. Leisure trips

Regarding leisure trips, the average duration is approximately 33 minutes, and the average distance is 10.6 kilometres. Leisure trips are on average the longest of the trip purposes surveyed. A rather small percentage (36%) of leisure trips are made in less than 15 minutes (see Table 12), indicating that a high share of Viennese citizens has to travel longer to reach a leisure facility they accept worth to visit. The two most preferred travel modes for this trip purpose are walking and public transport, with an average trip duration of 35 minutes. This fact reveals the existence of leisure facilities in Vienna that are easily accessible and well connected to the pedestrian and public transport network. It should also be noted that walking and cycling are not only used as a means of transport, but as a part of the leisure activity itself, resulting in longer trips.



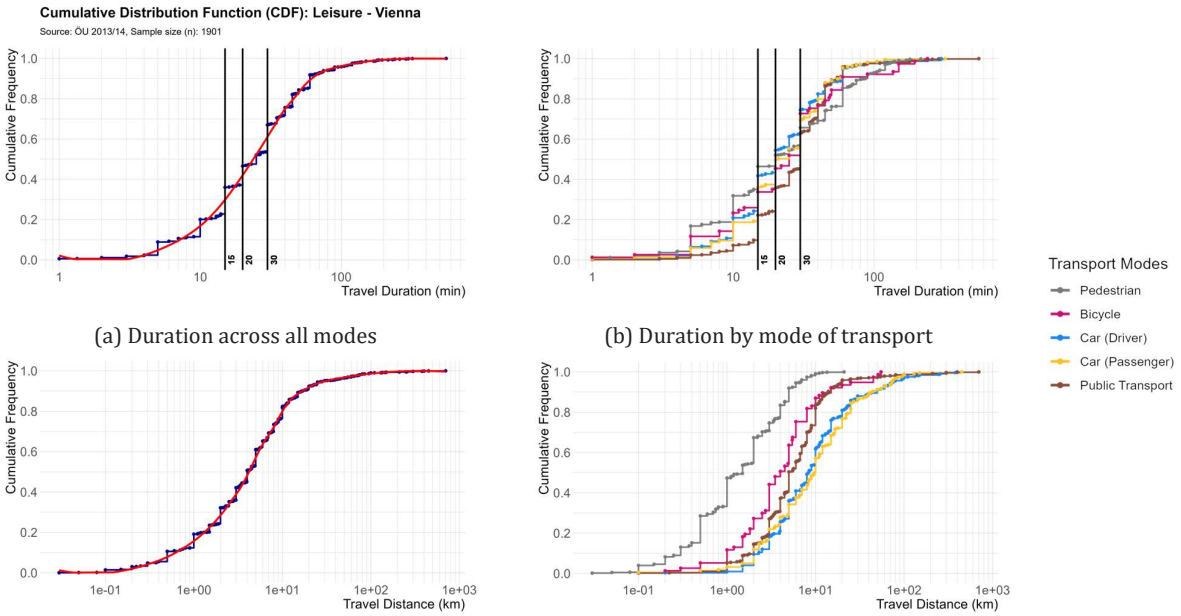
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 10: Density plot of leisure trip duration (a) and distance (b) by transport mode – Vienna

Table 11: Leisure trip statistics by transport mode - Vienna

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	1901	33.21	25.0	35.49	10.59	4.0	33.06
Pedestrians	659	34.77	20.0	35.93	2.24	1.5	2.36
Bicycle	77	36.70	25.0	43.77	7.24	4.0	10.79
Car (as Driver)	325	29.39	20.0	35.16	20.44	8.5	44.19
Car (as Passenger)	219	29.37	21.0	28.06	19.28	10.0	37.27
Public Transport	621	34.46	30.0	36.26	11.64	5.0	40.81



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 11: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Vienna

Table 12: Percentage of leisure trips conducted for different time stamps and modes- Vienna

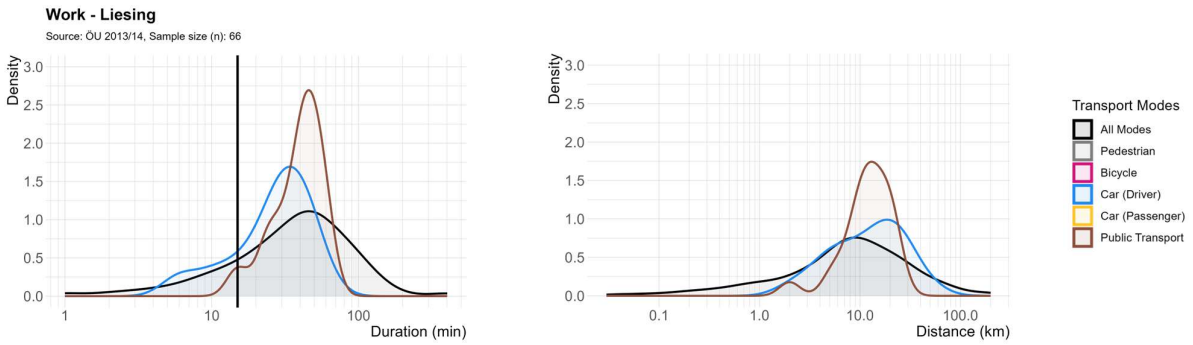
Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	20.1%	36.0%	46.6%	67.0%
Pedestrians	31.9%	46.4%	52.0%	65.7%
Bicycle	23.4%	33.8%	45.5%	72.7%
Car (as Driver)	20.9%	41.8%	54.5%	74.5%
Car (as Passenger)	18.7%	36.1%	49.8%	69.4%
Public Transport	7.2%	22.2%	35.7%	62.8%

4.5.Trip Characteristics – Liesing

The survey used for this analysis includes a limited number of trips made by Liesing's residents. For greater accuracy and to avoid misleading results, we analyse the trip characteristics of travel modes with more than 20 entries in the sample. However, the sample size of the general statistics presented in the following tables, includes all the travel modes represented in the sample, irrespective of their number of entries only.

4.5.1.Work trips

According to Table 13, residents of Liesing tend to travel slightly longer on average (33 minutes) than those on average for the entire city of Vienna (29 minutes) to reach their work location. A high share of the work-trips is made by car, with an average trip duration of 25 minutes. The duration and distance of work trips made by public transport are both longer than the corresponding figures for Vienna. This is mainly due to the fact that a considerable number of work opportunities are located in the city centre of Vienna, necessitating longer commutes. Additionally, less than 20% of the reported work trips are completed in less than 15 minutes.

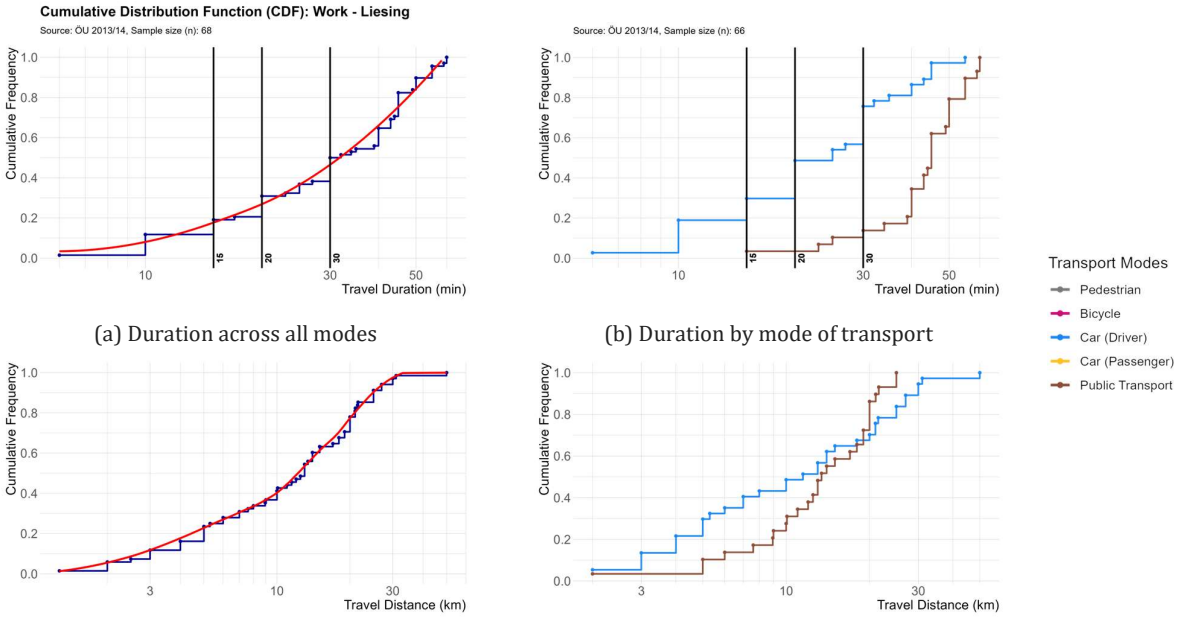


(a) Duration by mode of transport (b) Distance by mode of transport

Figure 12: Density plot of work trip duration (a) and distance (b) by transport mode – Liesing

Table 13: Work trip statistics by transport mode - Liesing

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	68	32.85	31.0	15.10	13.78	13.0	9.27
Pedestrians	Insufficient sample size for analysis						
Bicycle							
Car (as Driver)	37	25.22	25.0	12.34	14.06	11.5	11.05
Car (as Passenger)	Insufficient sample size for analysis						
Public Transport	29	43.93	45.0	10.86	14.25	13.4	6.21



(a) Duration across all modes (b) Duration by mode of transport

(c) Distance across all modes (d) Distance by mode of transport

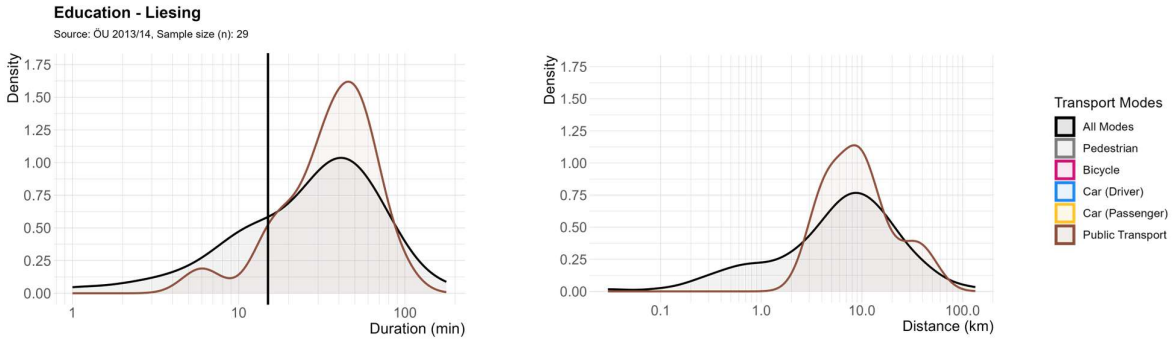
Figure 13: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Liesing

Table 14: Percentage of work trips conducted for different time stamps – Liesing

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	11.8%	19.1%	30.9%	50.0%
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)	18.9%	29.7%	48.6%	75.7%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	-	3.4%	3.4%	13.8%

4.5.2. Educational trips

For educational trips, the most preferred mode of Liesing's students is public transport. In the sample, students represent only the 21% of the total population and the education-related trips reported are not enough to understand their travel behaviour in depth. Nevertheless, on average Liesing's students travel longer to reach their educational institutions than students in the greater area of Vienna, while only the 32% of the reported trips are completed within 15 minutes.



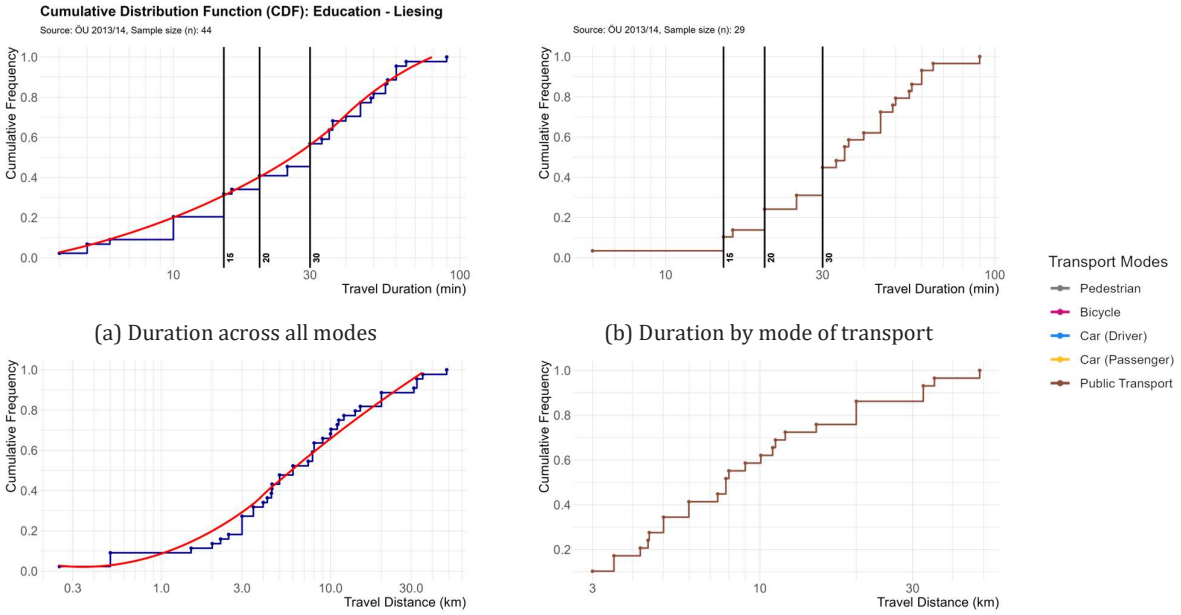
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 14: Density plot of educational trip duration (a) and distance (b) by transport mode – Liesing

Table 15: Educational trip statistics by transport mode - Liesing

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	44	31.2	30.0	20.02	10.1	6.0	10.87
Pedestrians	Insufficient sample size for analysis						
Bicycle							
Car (as Driver)							
Car (as Passenger)							
Public Transport	29	37.3	35.0	18.5	12.38	7.8	11.52



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

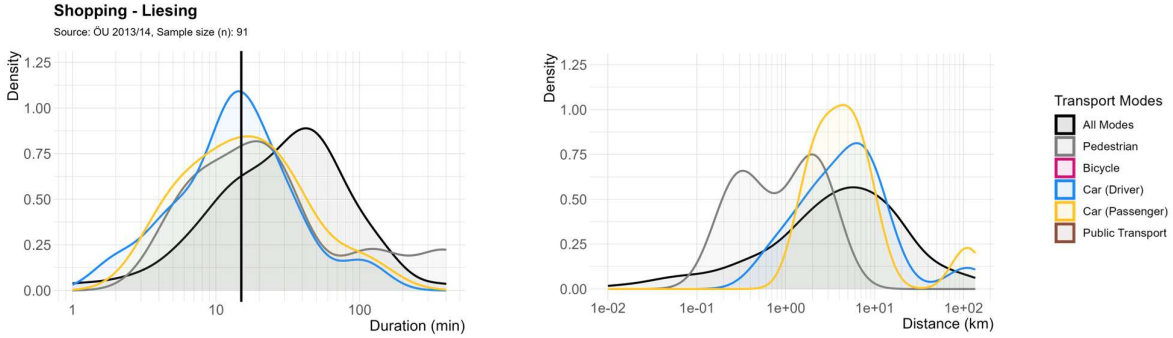
Figure 15: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Liesing

Table 16: Percentage of educational trips conducted for different time stamps – Liesing

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	20.5%	31.8%	40.9%	56.8%
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)				
Car (as Passenger)				
Public Transport	3.5%	10.3%	24.1%	44.8%

4.5.3. Shopping trips

In Liesing, the average trip duration is 21 minutes while driving is the most preferred mode. Walking is also a popular mode for this trip purpose. However, walking trips are considerably longer than those in Vienna (32 minutes compared to 16.5 minutes). The combination of mode choice and trip characteristics suggests that proximity to retail facilities is lower in Liesing, which in turn enables the use of motorised vehicles.



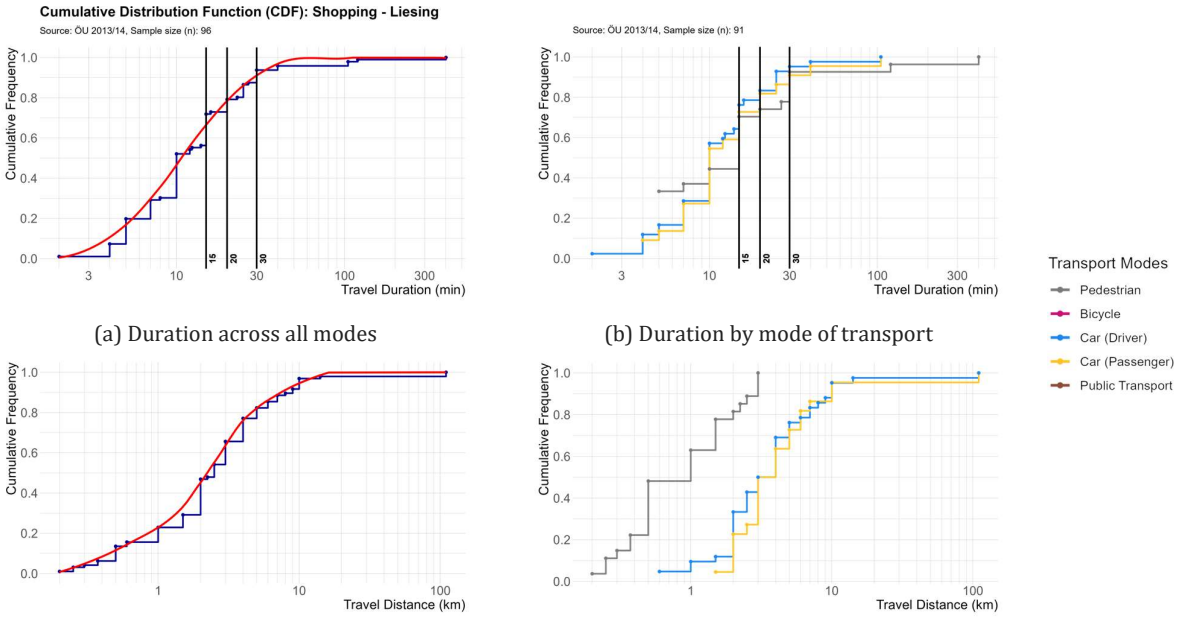
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 16: Density plot of shopping trip duration (a) and distance (b) by transport mode – Liesing

Table 17: Shopping trip statistics by transport mode - Liesing

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	96	20.52	10.0	43.62	5.47	2.5	15.58
Pedestrians	27	32.06	15.0	77.17	1.15	1.0	0.92
Bicycle	Insufficient sample size for analysis						
Car (as Driver)	42	14.94	10.0	16.29	6.66	3.5	16.61
Car (as Passenger)	22	17.77	10.0	21.41	9.0	3.5	22.68
Public Transport	Insufficient sample size for analysis						



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

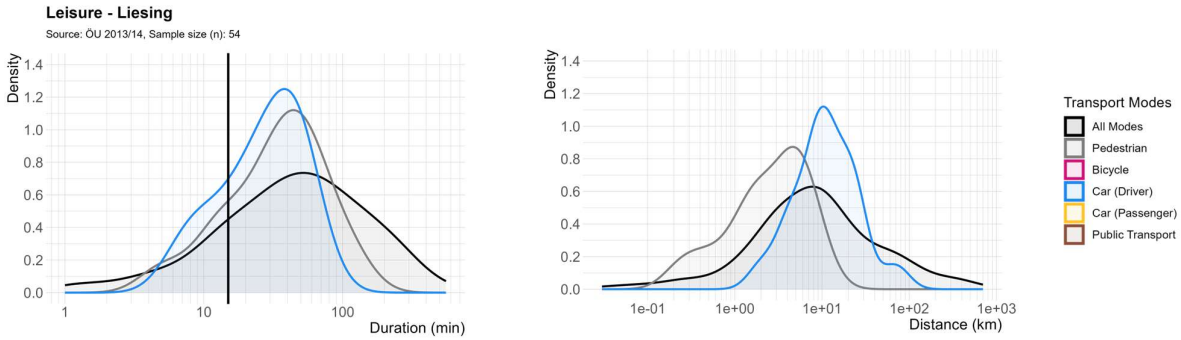
Figure 17: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Liesing

Table 18: Percentage of shopping trips conducted for different time stamps – Liesing

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	52.1%	71.9%	79.2%	93.8%
Pedestrians	44.4%	70.4%	74.1%	92.6%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)	57.1%	76.2%	83.3%	95.2%
Car (as Passenger)	54.5%	72.7%	81.8%	90.9%
Public Transport	Insufficient sample size for analysis			

4.5.4. Leisure trips

For leisure trips, the average trip duration is 34 minutes and distance 10 kilometres (Table 19). These results do not differ vastly from the ones of Vienna, where the average trip duration is 33 minutes. In Liesing, walking is the most preferred mode for this trip purpose with an average trip duration of 42 minutes. However, according to Table 20 only the 28% of walking trips last up to 15 minutes (but important to mention, in this category walking trips for pleasure itself and walking to a specific venue for leisure activity (e.g. public pool, gym) are included). Due to the location of Liesing, people may prefer to either visit a natural park nearby or use their private vehicle to access a leisure facility outside of Vienna.

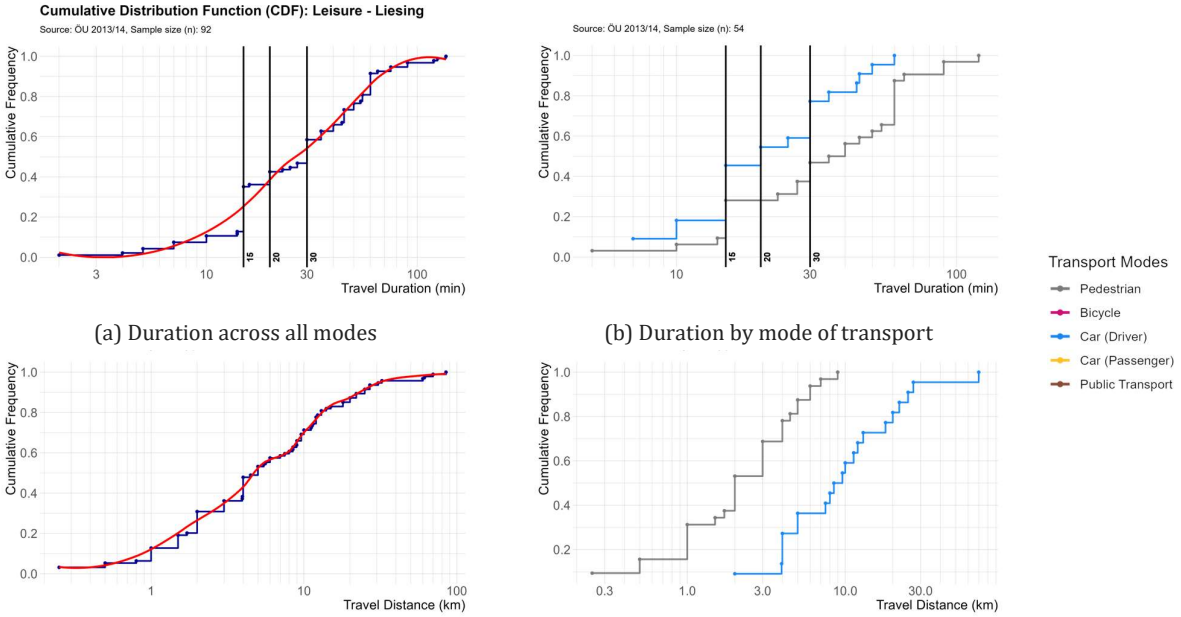


(a) Duration by mode of transport (b) Distance by mode of transport

Figure 18: Density plot of leisure trip duration (a) and distance (b) by transport mode – Liesing

Table 19: Leisure trip statistics by transport mode - Liesing

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	92	34.03	30.0	24.43	10.13	4.7	14.78
Pedestrians	32	41.72	37.5	26.97	2.79	2.0	2.17
Bicycle	Insufficient sample size for analysis						
Car (as Driver)	22	24.68	20.0	14.73	13.27	9.0	14.69
Car (as Passenger)	Insufficient sample size for analysis						
Public Transport							



(a) Duration across all modes (b) Duration by mode of transport

(c) Distance across all modes (d) Distance by mode of transport

Figure 19: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Liesing

Table 20: Percentage of leisure trips conducted for different time stamps – Liesing

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	10.6%	35.1%	42.6%	58.5%
Pedestrians	6.3%	28.1%	28.1%	46.8%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)	18.2%	45.5%	54.5%	77.3%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport				

4.6.Travel behaviour across different socioeconomic groups

The present section of the analysis is concerned with an examination of modal split and trip characteristics of different socioeconomic groups in Vienna. The main findings of the analysis are presented here, but the detailed results of the analysis can be found in **Appendix A** and **G**.

4.6.1.Gender

- Work trips:
  - Public transport is the most utilised mode for both genders.
  - Men have a marginally higher share of car trips compared to women.
  - Women travel shorter distances than men but with similar travel times.
- Educational trips:
  - Public transport is the leading mode for both genders.
  - Travel patterns for education trips are nearly identical between men and women.
- Shopping trips:
  - Walking is the dominant mode for both genders.
  - Women are more likely to travel as car passengers for shopping.
- Leisure trips:
  - Walking and public transport are the two most used modes for both genders.

4.6.2.Income

The dataset categorizes the economic situation of households as very poor, poor, average, good, and very good. For the purpose of the analysis, we have been merged the first two categories (very poor and poor) into a single category called low income, and the last two categories (good and very good) into a single category called high income.

- Work trips:
  - Low-income individuals rely more on public transport and walking.
  - High-income individuals use cars more frequently for work trips.
  - Travel times are similar, but low-income individuals travel shorter distances.
- Educational trips:
  - Low-income individuals demonstrate a greater reliance on walking and public transport.
  - Car use is low across all income groups for education trips.
- Shopping trips:
  - Low-income individuals use walking and public transport more frequently.
  - High-income individuals prefer using cars for shopping trips.
  - Walking and public transport remain prevalent across all income groups
- Leisure trips:
  - Low-income individuals prefer walking, public transport, and bicycles.
  - High-income individuals travel longer distances and use cars more frequently for leisure activities.

4.6.3. Age

In order to analyse travel behaviour across age in Vienna, the sample has been divided into four groups. The groups are the following:

1. Children/Students (up to 18 years old)
2. Young adults (19 to 39 years old)
3. Middle-aged adults (40 to 59 years old)
4. Old adults (over 60 years old)

- Work trips:
  - Children/Students allocate the most time to commuting yet travel shorter distances.
  - Young adults demonstrate a higher preference for car use, yet they also utilize public transport and walking.
  - Middle-aged adults exhibit a strong preference for car use for work-related trips.
  - For older adults, the car is the dominant mode for work-related trips.
- Educational trips:
  - Children/Students rely heavily on public transport and walking.
  - Young and middle-aged adults travel longer distances for education.
- Shopping trips:
  - Walking is the dominant mode across all age groups.
  - Young and middle-aged adults have the highest proportion of shopping trips made on foot.
  - Middle-aged adults tend to travel slightly longer distances for shopping.
- Leisure trips:
  - Young adults exhibit a higher preference for car use in relation to leisure trips.
  - Middle-aged adults allocate the most time to leisure travel.
  - Older adults demonstrate a significantly reduced propensity to travel for leisure activities.

5. UTRECHT

5.1. General characteristics of Utrecht and LL location

The Municipality of Utrecht is located in the Province of Utrecht, which is one of the 12 provinces that constitute the Netherlands. The city of Utrecht is the fourth most populous city in the Netherlands, with an estimated population of approximately 375,000 inhabitants. The city's reputation is largely built on its extensive cycling infrastructure and public transport system, offering seamless connections to all major cities and towns in the country.

Utrecht's Living Lab is "Overvecht Noord" and is located in the Northeast of Utrecht. The area has a population of approximately 35,000 inhabitants, and it is served by the local public transport system. In addition, it offers a wide range of cycling-related services.

Figure 20 shows the map of Utrecht and the location of the Utrecht Living Lab "Overvecht" (orange dot).

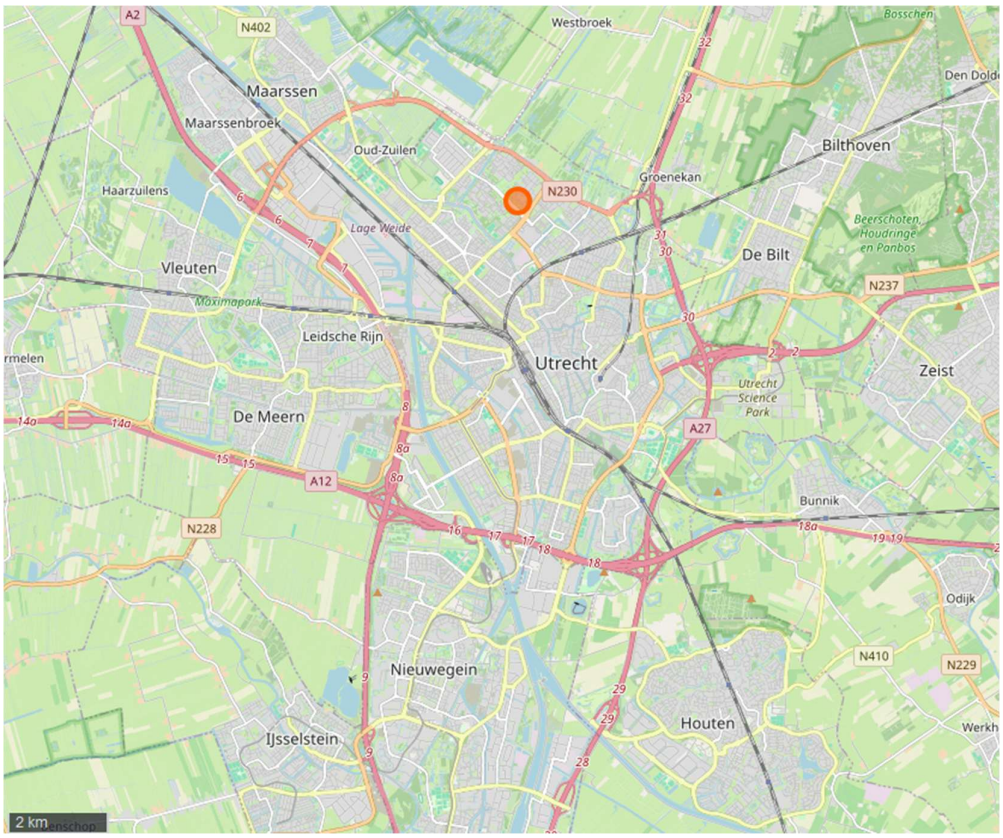


Figure 20: Location of the Utrecht Living Lab "Overvecht" (orange dot) (Source: OSM (2024))

5.2.Descriptive statistical analysis

For the descriptive statistical analysis for the city of Utrecht and Utrecht's LL location, the dataset "Onderweg in Nederland 2021 (ODiN)" (5) was used. A list of socioeconomic variables, both for households and individuals, was selected and presented in Tables Table 21 and Table 22 respectively.

It is important to acknowledge the limitations imposed by the relatively modest sample size of trips conducted by the residents of the "Overvecht Noord" region. This restricts the scope and generalisability of the analysis' results. To mitigate these limitations, a comprehensive analysis of the entire Overvecht area is conducted, encompassing both the northern and southern region.

The sample used for this part of the analysis is the *total resident population* within the area (Utrecht or Overvecht), with no filtering for specific trip purposes. Furthermore, the sample of survey respondents who did not provide a valid response to one or more of the selected questions was excluded from the sample.

Table 21: Socioeconomic characteristics of households (Utrecht & Overvecht) – Source: ODiN 2021

Socioeconomic Characteristics of Households

	Utrecht		LL Location (Overvecht)	
	n	**%**	**n**	**%**
Household size				
1 Person	1302	17.2	48	30.8
2 Persons	2587	34.1	49	31.4
3 Persons	1074	14.2	17	10.9
4+ Persons	2615	34.5	42	26.9
Car ownership				
0	1178	15.5	59	37.8
1	3653	48.2	75	48.1
2	2145	28.3	18	11.5
3	449	5.9	3	1.9
4+	153	2.0	1	0.6
Number of car driving license per household				
0	425	5.6	28	17.9
1	1920	25.4	56	35.9
2	4398	58.0	63	40.4
3	605	8.0	5	3.2
4+	230	3.0	4	2.6

Table 22: Socioeconomic characteristics of individuals (Utrecht & Overvecht) – Source: ODiN 2021

Socioeconomic Characteristics of Individuals

	Utrecht		LL Location (Overvecht)	
	n	**%**	**n**	**%**
Gender				
Male	3750	49.5	85	54.5
Female	3828	50.5	71	45.5
Age Category (y.o.)				
6 – 14	775	10.2	12	7.7
15 – 19	461	6.1	9	5.8
20 – 24	486	6.4	12	7.7
25 – 34	1323	17.5	48	30.8
35 – 44	1070	14.1	23	14.7
45 – 54	1202	15.9	18	11.5
55 – 64	903	11.9	14	9.0
65+	1358	17.9	20	12.8
Occupation				
Student	1558	20.6	31	19.9
Employed	4126	54.4	82	52.6
Pensioner	1184	15.6	18	11.5
Other	710	9.4	25	16.0

The descriptive statistical analysis offers a detailed overview of the demographic profiles of residents in Utrecht and Overvecht region. With respect to gender, the population in the sample is almost equally distributed in Utrecht, in Overvecht however, the sample of men is larger than that of women by 10%. Furthermore, a significant disparity is observed in the ownership of vehicles between the two areas. While the majority of households in Utrecht possess at least one car, in Overvecht, the proportion of households without cars is higher. Regarding occupation, both samples are predominantly comprised of employed individuals and students.

5.3.Modal split

As illustrated in Figure 21, the modal split by trip purpose for the city of Utrecht reveals distinct patterns in transportation choices. For commuting to work, driving is the most preferred mode for Utrecht residents, followed by cycling. When it comes to educational trips, cycling stands as the clear favourite. As for shopping trips, cycling is the dominant mode, but there is also a high share of trips made by foot or car. With respect to leisure trips, here walking emerges as the predominant mode with 43%, followed by bicycle and car usage. It is important to be noted that in the leisure trips category are included walking trips for recreation, so this might strongly affect modal split. Furthermore, the findings indicate that public transportation is remarkably underutilized for daily travel in Utrecht.

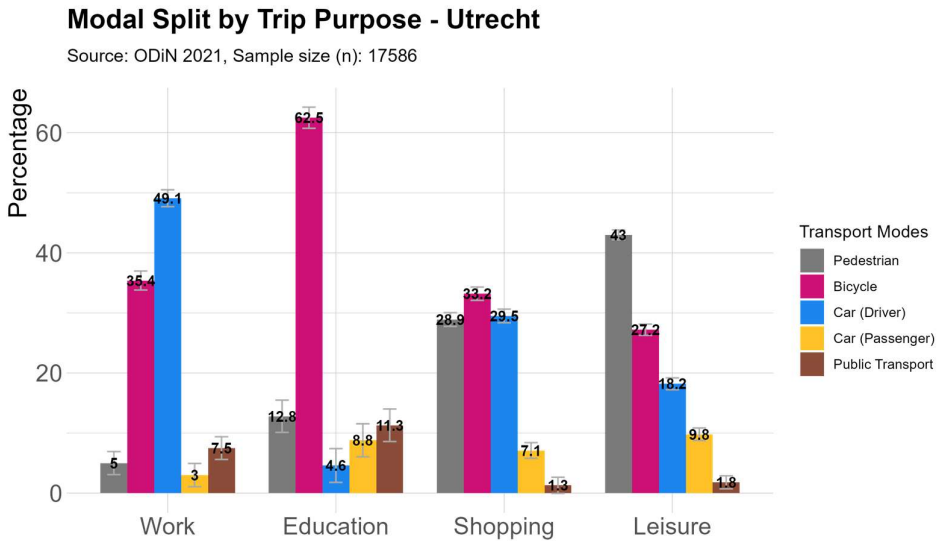


Figure 21: Modal split by trip purpose – Utrecht

The results of the modal split analysis in Overvecht, presented in Figure 22, indicate a preference for cycling and walking, particularly for shopping and leisure trips. Conversely, commutes are predominantly performed by car and bicycle, mirroring the modal split observed in Utrecht. Cycling emerges as the predominant mode for educational trips, followed by public transportation. However, the small sample size for the Overvecht area may impact the representativeness of the results. This limitation is also reflected in the error bars shown in the plots.

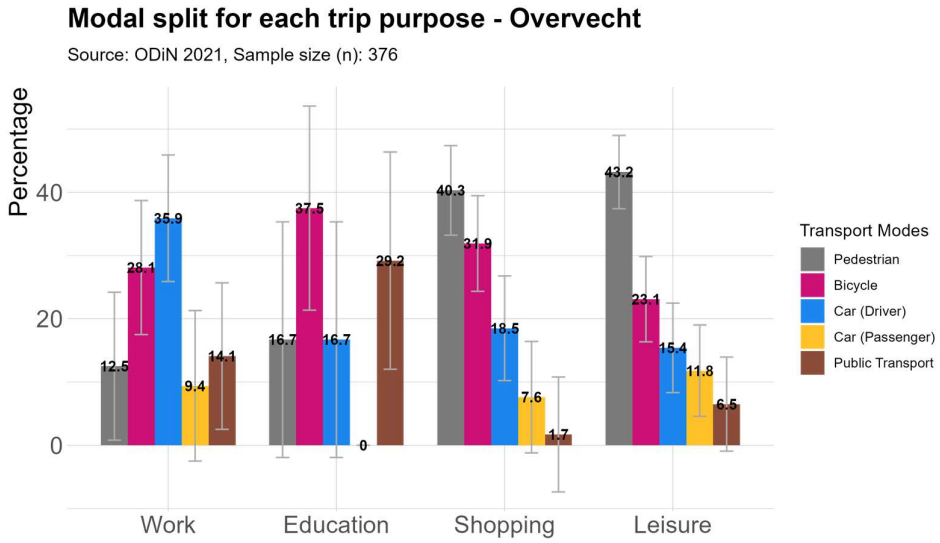
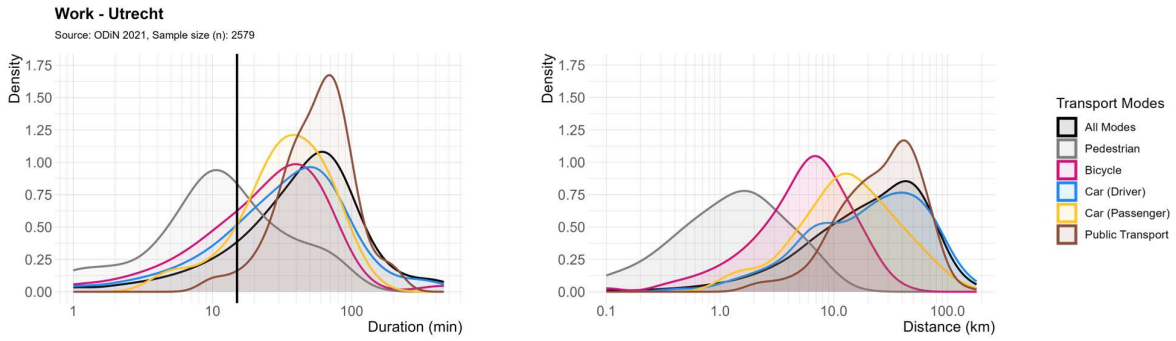


Figure 22: Modal split by trip purpose - Overvecht

5.4.Trip Characteristics – Utrecht

5.4.1. Work trips

The mean duration of a work trip in Utrecht is approximately 26 minutes, with an average distance of 15 kilometres. As indicated in Table 24, nearly 41% of the work trips in Utrecht are completed in less than 15 minutes. Driving is the most prevalent travel mode for work-related trips, with an average duration of 27 minutes, while only 30% of these trips are completed in under 15 minutes. This might be attributed to the fact that a high share of work facilities is not located in the city centre, necessitating longer commutes. Cycling is also a popular trip mode for work trips, with an average duration of 20 minutes, and approximately 57% of these commutes lasting up to 15 minutes. In the case of public transport commutes, the average duration is close to 56 minutes, with nearly 3% of these trips are completed in less than 15 minutes. Finally, the travel mode with the highest proportion of completed trips in less than 15 minutes is walking (82.3%).



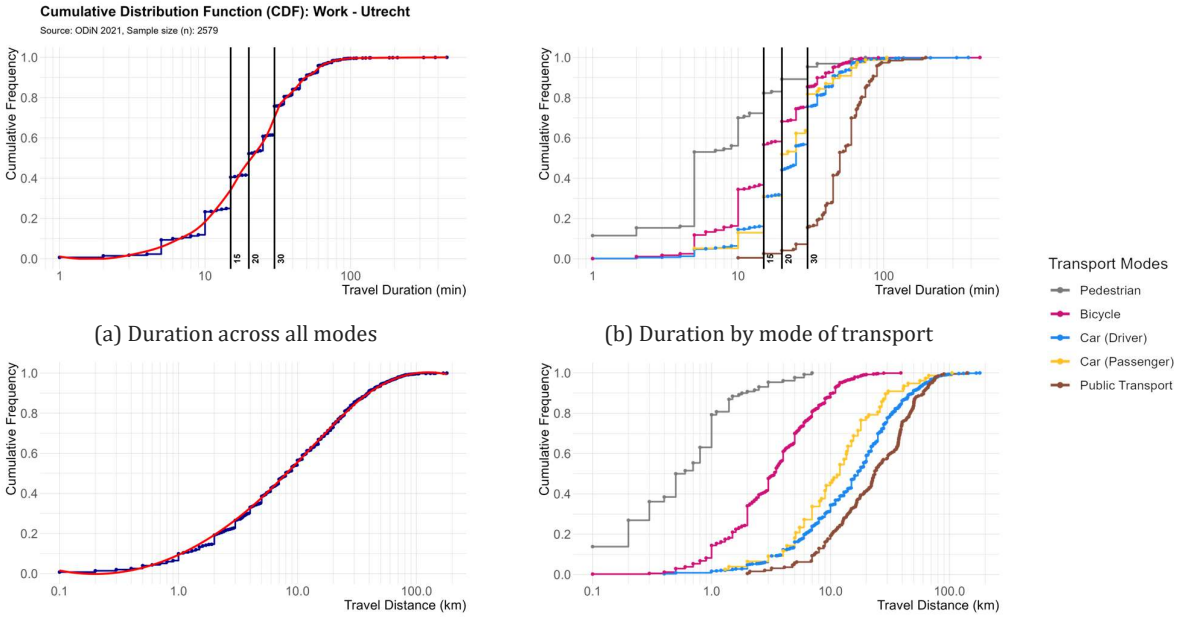
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 23: Density plot of work trip duration (a) and distance (b) by transport mode – Utrecht

Table 23: Work trip statistics by transport mode - Utrecht

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	2579	26.01	20.00	22.52	15.29	8.00	18.56
Pedestrians	130	11.18	5.00	12.44	0.94	0.55	1.20
Bicycle	913	20.04	15.00	19.78	4.65	3.40	4.26
Car (as Driver)	1266	27.31	25.00	21.01	22.20	17.00	20.47
Car (as Passenger)	77	26.47	20.00	17.36	16.23	12.00	16.96
Public Transport	193	55.50	50.00	24.87	29.62	23.60	21.58



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

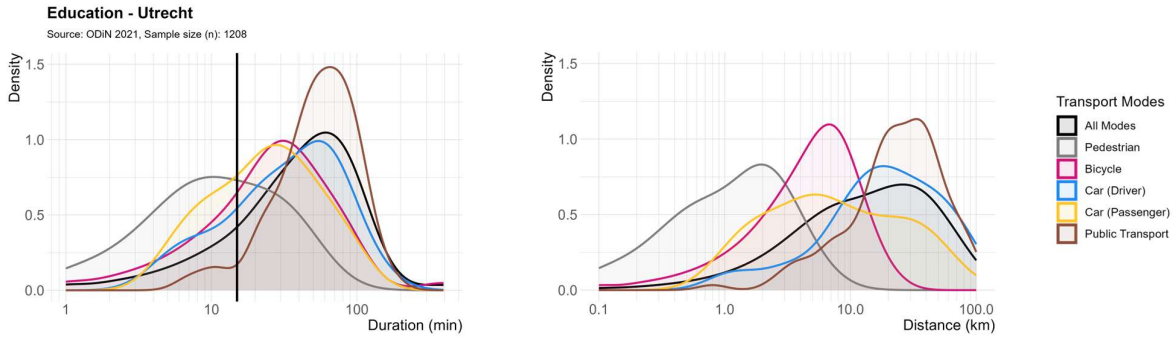
Figure 24: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Utrecht

Table 24: Percentage of work trips conducted for different time stamps – Utrecht

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	23.3%	40.5%	52.2%	75.8%
Pedestrians	70.0%	82.3%	89.2%	95.4%
Bicycle	34.5%	56.7%	68.2%	85.4%
Car (as Driver)	14.6%	30.9%	44.2%	75.6%
Car (as Passenger)	13.0%	31.2%	51.9%	81.8%
Public Transport	0.5%	2.6%	4.1%	15.5%

5.4.2. Educational trips

In Utrecht, the average duration of the educational trips is close to 22 minutes and the most prevalent travel mode for this category is cycling. Cycling trips last on average 18 minutes and more than 60% of these trips are completed in less than 15 minutes. According to Table 25, modes such as public transport and car are preferred for longer trips to educational institutions, while the share of trips of less than 15 minutes is 3.5% and 21% respectively. Moreover, walking is the mode with the highest share of trips completed up to 15 minutes. Overall, the results show a high degree of proximity to educational institutions a fact that allows the use of sustainable modes such as walking and cycling.



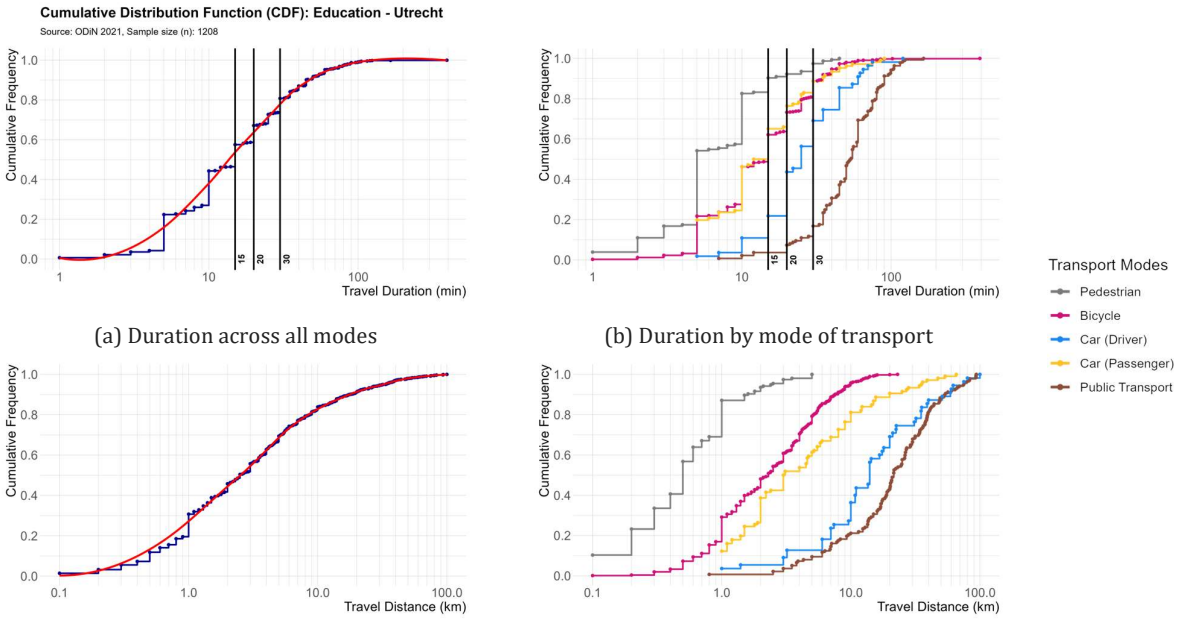
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 25: Density plot of educational trip duration (a) and distance (b) by transport mode – Utrecht

Table 25: Educational trip statistics by transport mode - Utrecht

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	1208	21.58	15.00	23.02	6.99	2.50	12.53
Pedestrians	155	8.97	5.00	7.94	0.77	0.50	0.87
Bicycle	755	17.69	15.00	19.10	3.38	2.30	3.20
Car (as Driver)	55	31.02	25.00	20.77	21.64	14.00	21.59
Car (as Passenger)	106	17.74	13.50	15.67	8.05	3.05	11.58
Public Transport	137	56.47	54.00	26.66	27.25	21.50	20.74



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

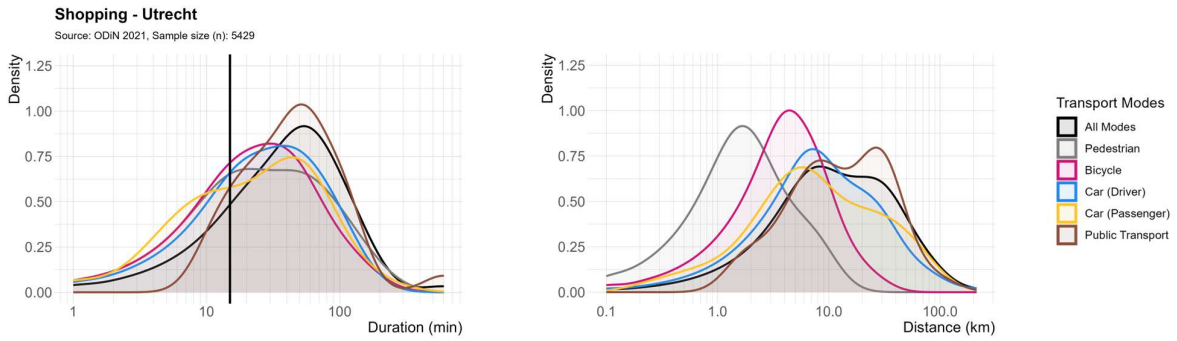
Figure 26: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Utrecht

Table 26: Percentage of educational trips conducted for different time stamps – Utrecht

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	44.3%	57.5%	67.1%	80.8%
Pedestrians	82.6%	90.3%	92.3%	97.4%
Bicycle	46.2%	62.1%	73.2%	88.7%
Car (as Driver)	10.9%	21.8%	43.6%	69.1%
Car (as Passenger)	46.2%	65.1%	76.4%	88.7%
Public Transport	2.2%	3.5%	7.3%	16.8%

5.4.3. Shopping trips

On average, Utrecht residents travel about 12 minutes and 3.4 kilometres to go shopping. The most preferred means of transport is the bicycle, followed by the car and then walking. Shopping trips made by bicycle last on average 11 minutes, and almost 87% percent of them last up to 15 minutes. Similarly, walking trips last on average 10 minutes, while 88% of them last less than 15 minutes. As expected, trips made by car take slightly longer (13 minutes), but they also cover much longer distances than trips made on foot or by bicycle. Individuals who choose to go shopping by car, may visit shopping centres far from the city centre, where they can buy not only food, but also clothes or electronics. It is worth mentioning that the trips included in this category, are not only trips for food but also other types of shopping. In general, shopping trips in Utrecht are mostly short, with 84% of them lasting up to 15 minutes. This result shows a high degree of proximity to shopping facilities.



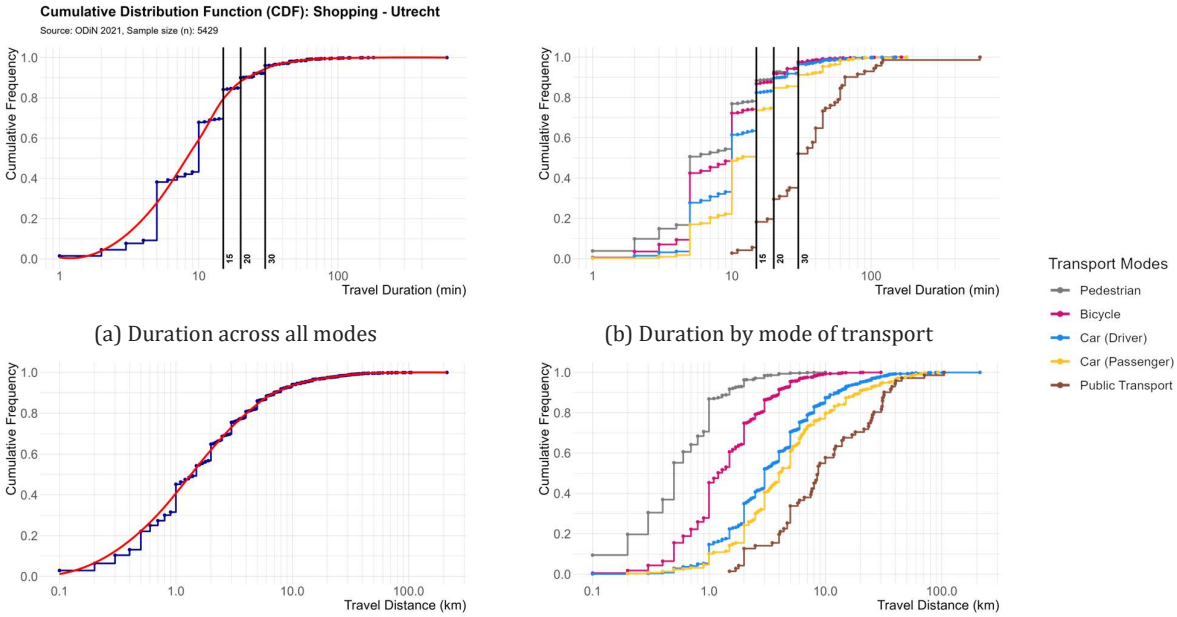
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 27: Density plot of shopping trip duration (a) and distance (b) by transport mode – Utrecht

Table 27: Shopping trip statistics by transport mode - Utrecht

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	5429	12.12	10.00	14.69	3.39	1.50	7.17
Pedestrians	1567	10.15	5.00	11.88	0.75	0.50	0.79
Bicycle	1804	10.74	10.00	10.10	1.90	1.20	2.01
Car (as Driver)	1600	12.94	10.00	11.24	5.89	3.00	9.61
Car (as Passenger)	387	16.67	12.00	15.98	8.37	4.00	12.17
Public Transport	71	47.18	30.00	71.80	15.63	8.70	17.30



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

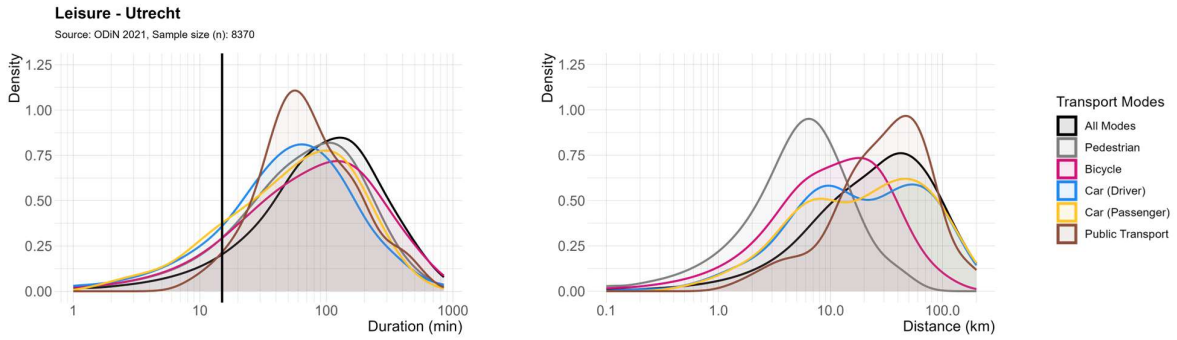
Figure 28: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Utrecht

Table 28: Percentage of shopping trips conducted for different time stamps – Utrecht

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	67.8%	84.1%	90.0%	96.1%
Pedestrians	76.9%	88.4%	92.5%	97.3%
Bicycle	72.2%	86.8%	91.8%	97.6%
Car (as Driver)	61.5%	82.4%	89.6%	96.4%
Car (as Passenger)	48.6%	73.6%	84.8%	91.2%
Public Transport	2.8%	18.3%	29.6%	52.1%

5.4.4. Leisure trips

On average, leisure trips in Utrecht last approximately 38 minutes. The predominant mode is walking, with an average duration of 42 minutes. According to Table 30, only the 29% of leisure walking trips are completed in less than 15 minutes. The reason for this small percentage is that this trip purpose category includes trips for either social recreation (such as visiting friends or relatives or other social recreational activities) or recreational walking, which affects both trip duration and distance. In addition, a lot of leisure trips are made by bicycle. Cycling is the travel mode with the highest share of recreational trips made in less than 15 minutes (61.4%). Overall, a rather small percentage (43%) of leisure trips in Utrecht is completed in less than 15 minutes. However, this figure may not indicate a lack of proximity to leisure facilities, but rather that people in Utrecht prefer cycling and walking as a leisure activity in itself.



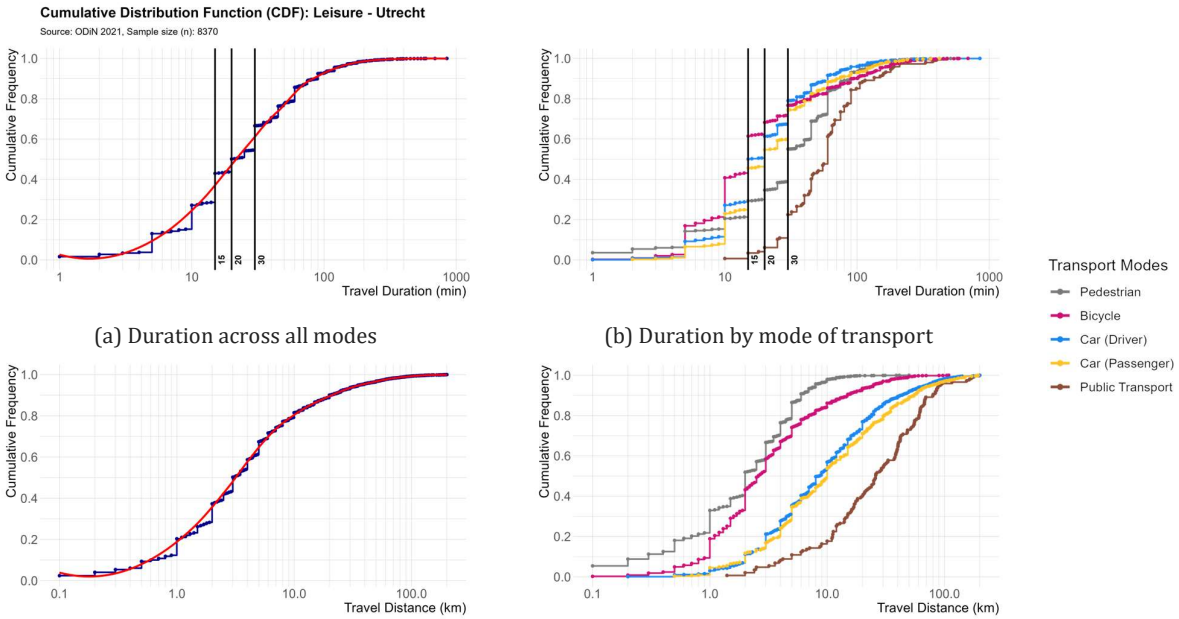
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 29: Density plot of leisure trip duration (a) and distance (b) by transport mode – Utrecht

Table 29: Leisure trip statistics by transport mode - Utrecht

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	8370	37.70	20.00	47.96	8.77	3.00	17.44
Pedestrians	3603	41.74	30.00	41.03	2.96	2.00	3.04
Bicycle	2274	35.77	15.00	58.79	5.94	2.60	9.57
Car (as Driver)	1523	29.27	15.00	41.79	17.46	8.60	24.76
Car (as Passenger)	823	34.77	20.00	44.63	20.78	10.00	28.88
Public Transport	147	72.52	60.00	68.14	37.61	26.00	35.90



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 30: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Utrecht

Table 30: Percentage of leisure trips conducted for different time stamps – Utrecht

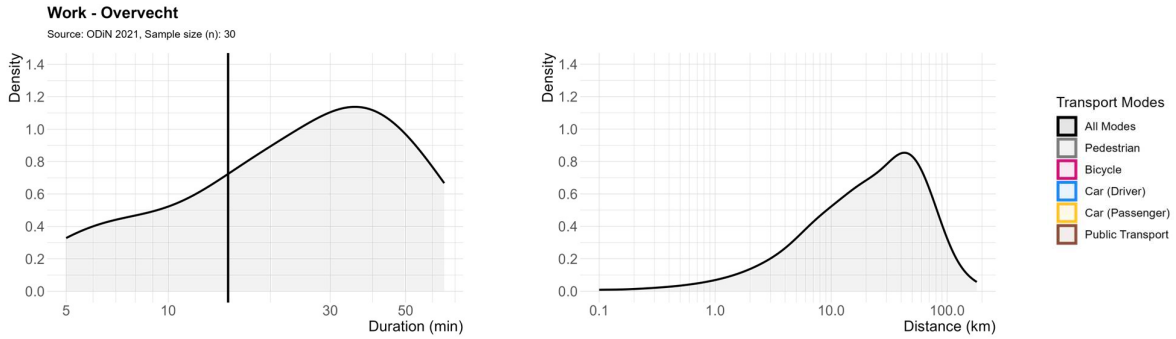
Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	27.1%	43.0%	50.1%	66.6%
Pedestrians	20.6%	29.3%	34.7%	55.0%
Bicycle	40.8%	61.4%	68.2%	76.7%
Car (as Driver)	27.2%	50.0%	61.3%	79.0%
Car (as Passenger)	23.0%	45.6%	54.7%	74.4%
Public Transport	0.7%	3.4%	6.1%	22.4%

5.5.Trip Characteristics – Overvecht

The survey used for this analysis includes a limited number of trips made by Overvecht's residents. For greater accuracy and to avoid misleading results, we analyse the trip characteristics of travel modes with more than 20 entries in the sample. However, the sample size of the general statistics presented in the following tables, includes all the travel modes represented in the sample, irrespective of their number of entries only.

5.5.1.Work trips

In Overvecht, the average duration of a commuting trip is 26 minutes, with only the 27% of these trips are completed in less than 15 minutes. In terms of time and distance, the figures are consistent with those observed for work-related trips in Utrecht (see Table 23). In Overvecht, however, the proportion of trips lasting up to 15 minutes is lower. Unfortunately, the limited sample size of work trips in the Overvecht region (n <20 for each mode) cannot provide us with a meaningful insight into the duration and distance values for each mode separately.

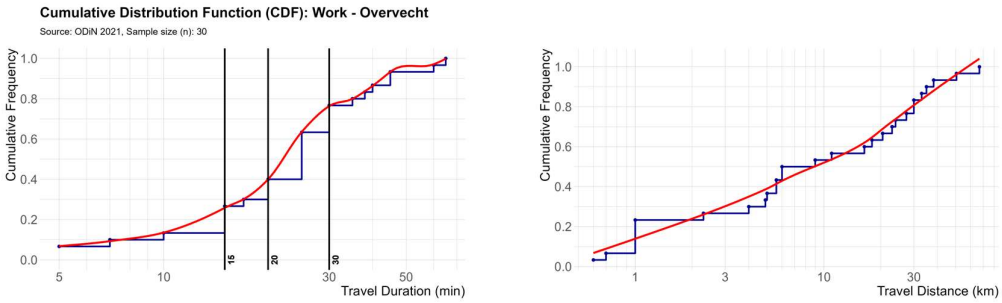


(a) Duration by mode of transport (b) Distance by mode of transport

Figure 31: Density plot of work trip duration (a) and distance (b) by transport mode – Overvecht

Table 31: Work trip statistics by transport mode - Overvecht

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	30	26.2	25.0	14.5	15.95	7.5	16.9
Pedestrians	Insufficient sample size for analysis						
Bicycle							
Car (as Driver)							
Car (as Passenger)							
Public Transport							



(a) Duration across all modes (b) Distance across all modes

Figure 32: Cumulative distribution function (CDF) of work trip duration (a) and distance (b)– Overvecht

Table 32: Percentage of work trips conducted for different time stamps – Overvecht

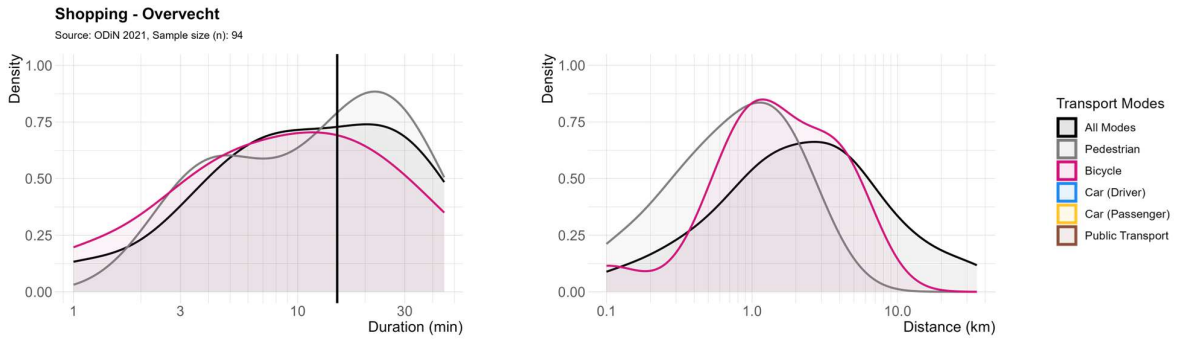
Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	13.3%	26.7%	40.0%	76.7%
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)				
Car (as Passenger)				
Public Transport				

5.5.2. Educational trips

The dataset "Onderweg in Nederland 2021 (ODiN)" does not contain a sufficient sample size (less than 20 entries) of educational trips in the Overvecht region. Therefore, as the analysis cannot provide us with a valuable insight into the travel behavior related to educational trips of the residents of Overvecht, this part of the analysis is skipped.

5.5.3. Shopping trips

In Overvecht, shopping trips last on average of 11 minutes. Walking is the most preferred mode of transport for shopping, followed by cycling. Walking and cycling trips to shopping facilities last approximately 10 minutes, while the share of trips lasting up to 10 minutes is equal to 89% and 78%, respectively. Overall, more than 80% of shopping trips in Overvecht, are completed in less than 15 minutes. These figures indicate that people in Overvecht tend to choose to shop locally and opt for sustainable transport modes.



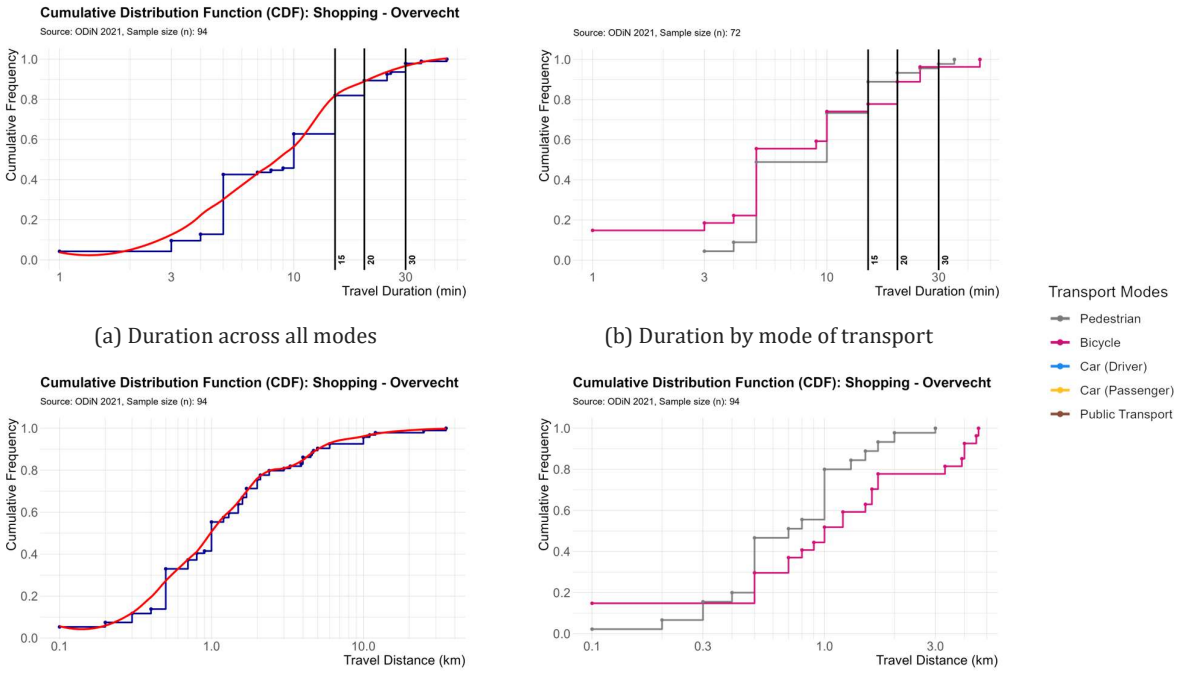
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 33: Density plot of shopping trip duration (a) and distance (b) by transport mode – Overvecht

Table 33: Shopping trip statistics by transport mode - Overvecht

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	94	11.34	10.0	8.52	2.52	1.0	4.82
Pedestrians	45	9.98	10.0	7.14	0.86	0.7	0.58
Bicycle	27	10.19	5.0	10.07	1.57	1.0	1.45
Car (as Driver)	Insufficient sample size for analysis						
Car (as Passenger)							
Public Transport							



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

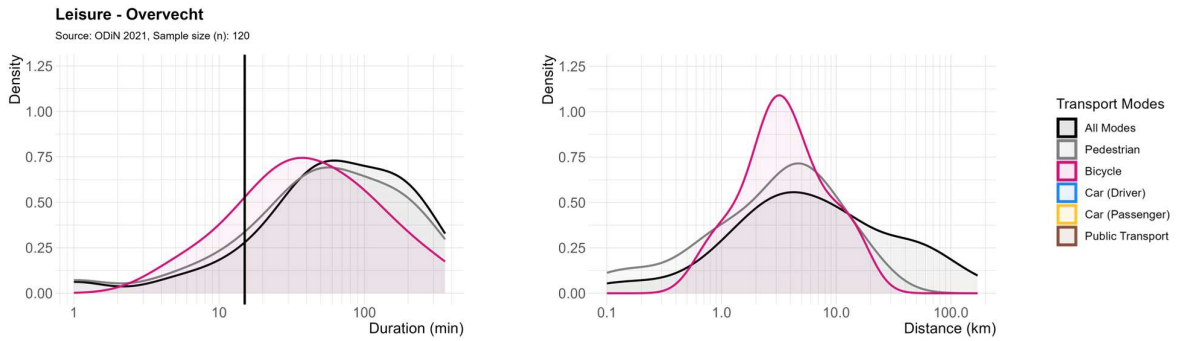
Figure 34: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Overvecht

Table 34: Percentage of shopping trips conducted for different time stamps – Overvecht

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	62.8%	81.9%	89.4%	97.9%
Pedestrians	73.3%	88.9%	93.3%	97.8%
Bicycle	74.1%	77.8%	88.9%	88.9%
Car (as Driver)	Insufficient sample size for analysis			
Car (as Passenger)				
Public Transport				

5.5.4. Leisure trips

The mean duration of a leisure trip in Overvecht is approximately 53 minutes, while the mean distance is almost 10 kilometres. Walking is again the prevalent mode for leisure trips, followed by cycling. A leisure trip made by foot lasts on average 57 minutes, while trips made by bicycle are shorter in duration but slightly longer in distance. Half of the leisure trips made by bicycle last up to 15 minutes, whereas for walking trips this percentage is relatively low (22%). It is noteworthy, that this trip purpose category includes trips for either social recreation or recreational walking, which might cause longer trips. In general, fewer leisure trips in Overvecht are completed in less than 15 minutes (32.5%) than in Utrecht as a whole (43%).



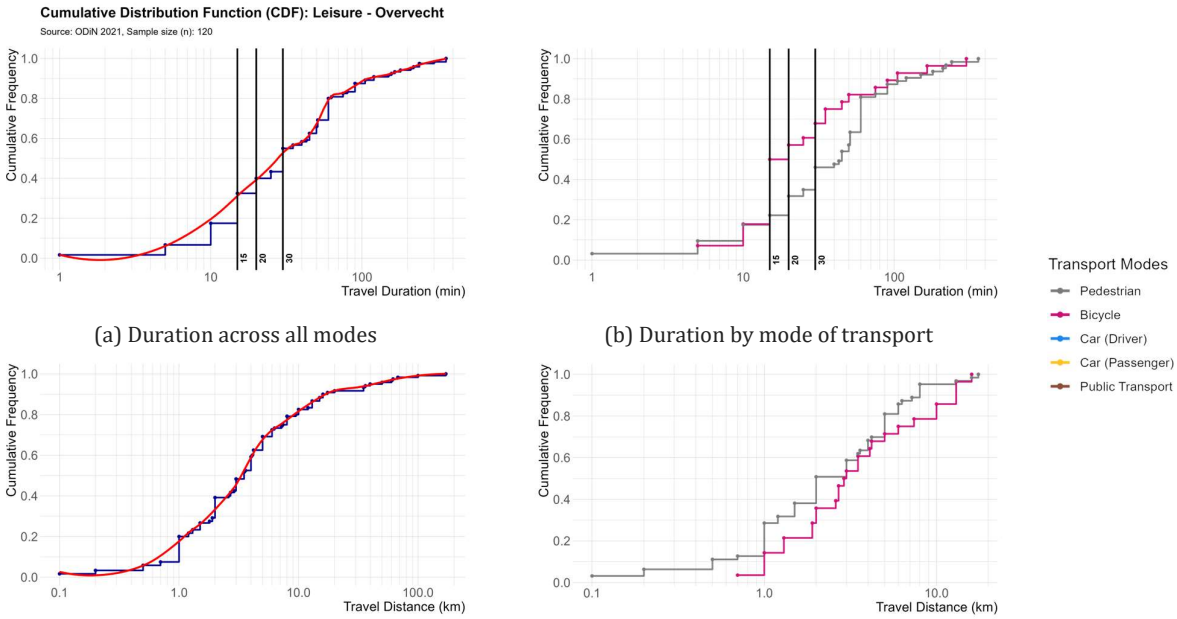
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 35: Density plot of leisure trip duration (a) and distance (b) by transport mode – Overvecht

Table 35: Leisure trip statistics by transport mode - Overvecht

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	120	53.87	30.0	67.1	9.51	3.5	20.97
Pedestrians	63	57.29	45.0	64.63	3.56	2.0	3.52
Bicycle	28	42.86	17.5	61.8	4.88	2.95	4.44
Car (as Driver)	Insufficient sample size for analysis						
Car (as Passenger)							
Public Transport							



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 36: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Overvecht

Table 36: Percentage of leisure trips conducted for different time stamps – Overvecht

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	17.5%	32.5%	40.0%	55.0%
Pedestrians	17.5%	22.2%	31.8%	46.0%
Bicycle	17.9%	50.0%	57.1%	67.9%
Car (as Driver)	Insufficient sample size for analysis			
Car (as Passenger)				
Public Transport				

5.6.Travel behaviour across different socioeconomic groups

The present section of the analysis is concerned with an examination of modal split and trip characteristics of different socioeconomic groups in Utrecht. The main findings of the analysis are presented here, but the detailed results of the analysis can be found in **Appendix B** and **G**.

5.6.1.Gender

- Work trips:
  - Men travel significantly longer distances than women for work-related trips, despite similar travel times, and use their cars more.
  - Women cycle to work more than men.
- Educational trips:
  - Both sexes travel similar distances, probably due to the proximity to educational institutions.
  - Men cycle and walk slightly more than women for educational trips.
  - Women are more likely to use public transport for education.
- Shopping trips:
  - Travel times and distances are similar for both sexes.
  - Men are more likely than women to use a car for shopping, while women are more likely to use a bicycle.
  - Walking is a popular mode of transport for shopping trips.
- Leisure trips:
  - Men and women spend roughly the same amount of time and cover similar distances on leisure trips.
  - Walking is the dominant mode of transport for leisure trips for both sexes.
  - Men are more likely than women to cycle and drive for leisure trips.

5.6.2.Income

The dataset categorizes the economic situation of households in Utrecht based on the standardised disposable income of the household (10% groups). In the Netherlands, households are devided by income level into ten groups (deciles) with an equal number of households. The income limits between these 10% groups vary from year to year. (https://opendata.cbs.nl/statline/?dl=D4D1#/CBS/nl/dataset/83931NED/table). For the purpose of the analysis, we have been merged the first five groups (first 10% group – fifth 10% group) into a single category called low income, and the last five groups (sixth 10% group – tenth 10% group) into a single category called high income.

- Work trips:
  - High income travellers cover longer distances for work-related trips.
  - High-income individuals predominantly opt for car, low-income individuals demonstrate a higher preference for bicycles.
- Educational trips:
  - The mean trip distance for educational purposes is found to be similar across different income groups.

- Bicycle is the most utilised travel mode across both income groups.
- Public transport usage is slightly higher for low-income individuals compared to high-income individuals.

❖ Shopping trips:
- High-income individuals travel significantly longer distances than low-income individuals.
- Low-income individuals usually walk or cycle for their shopping trips, while high-income individuals use their car and bicycle.

❖ Leisure trips:
- Individuals of a lower socio-economic status tend to undertake significantly longer journeys to engage in leisure activities in comparison to their high-income counterparts.
- There are no notable differences in terms of modal split across the two income groups.

5.6.3. Age

In order to analyse travel behaviour across age in Utrecht, the sample has been divided into four groups. The groups are the following:

1. Children/Students (up to 18 years old)
2. Young adults (19 to 39 years old)
3. Middle-aged adults (40 to 59 years old)
4. Old adults (over 60 years old)

❖ Work trips:
- Children/Students travel the least for work.
- Middle-aged adults and old adults travel shorter distances and less time than young adults.
- The bicycle is the predominant mode for work trips undertaken by children/students, while older adults are more likely to use the car.

❖ Educational trips:
- Young adults travel the longest and farthest for education-related trips.
- Young adults use public transport more than individuals in other age groups.

❖ Shopping trips:
- Children/Students have the highest travel time and the longest distance.
- Older age groups have similar travel times and distances.
- Young adults like to walk more when they go shopping. People in other age groups tend to use cars and bicycles more.

❖ Leisure trips:
- Children/Students spend more time traveling but cover shorter distances.
- The predominant mode of transportation for leisure trips among age groups 1, 2, and 3 is walking. For children and students, the predominant mode of transportation is bicycle.

6. BRUSSELS

6.1.General characteristics of Brussels and LL location

The Brussels Capital Region (hereafter, Brussels) is one of three Regions of Belgium, the others being Flanders and Wallonia. It is comprised of 19 municipalities and has a population of over 1.2 million inhabitants. It is located at the core of the Belgian transport network, offering numerous highways and railways for connections with other European cities. Moreover, Brussels boasts an extensive public transport infrastructure, comprising underground lines, trams, buses and bicycle infrastructure. Additionally, the city offers car, micromobility and cargo bike sharing services, thereby promoting sustainable urban mobility options.

The Living Labs of Brussels are located in two peripheral neighborhoods in the northern part of Brussels, namely Neder-over-Heembeek and Haren. Administratively, they are part of the municipality of the City of Brussels, but they are located on the northern periphery of the region, extending beyond the immediate central zone. Access to these Living Labs is facilitated by the local public transport system, predominantly through bus services. Finally, they offer limited car and micromobility sharing services.

Figure 37 shows the map of Brussels and the location of the Living Labs "Neder-over-Heembeek" and "Haren" (red pins)

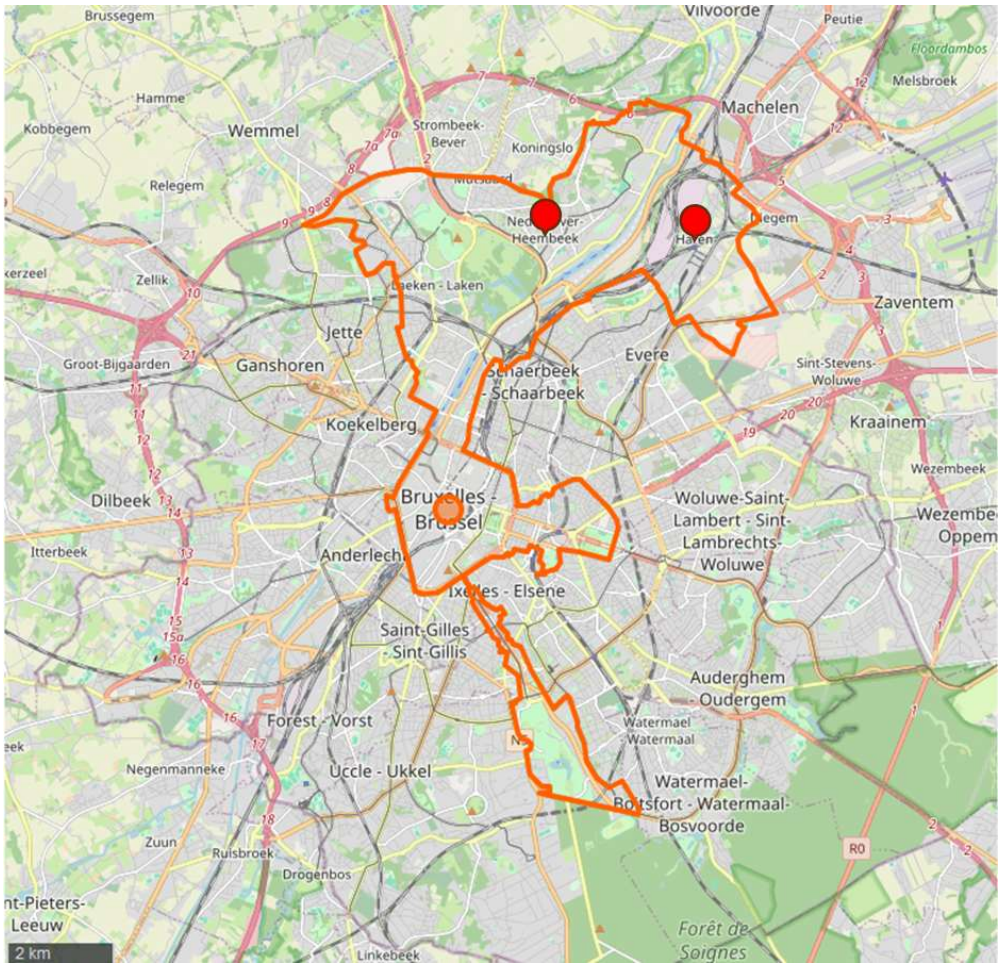


Figure 37: Location of the City of Brussels district (orange line) and the Brussels' Living Lab (red pins) (Source: OSM (2024))

6.2.Descriptive statistical analysis

For the descriptive statistical analysis for Brussels Capital Region (*hereafter*, ***Brussels***) and the LL location, the dataset "Onderzoek Verplaatsingsgedrag (OVG) 2021" (6) was used. A list of socioeconomic variables, both for households and individuals, was selected and presented in Tables Table 37 and Table 38 respectively.

It is important to acknowledge the limitations imposed by the relatively modest sample size of trips undertaken by the residents of the "Neder-over-Heembeek" and "Haren" regions. This restricts the scope and generalisability of the analysis' results. To address these limitations, a comprehensive analysis of the entire municipality City of Brussels (*hereafter*, ***Brussels City***) is conducted.

The sample used for this part of the analysis is the *total resident population* within the area (Brussels or Brussels City), with no filtering for specific trip purposes. Furthermore, the sample of survey respondents who did not provide a valid response to one or more of the selected questions was excluded from the sample.

Table 37 Socioeconomic characteristics of households (Brussels & Brussels City) – Source: OVG 2021

Socioeconomic Characteristics of Households

	Brussels		LL Location (Brussels City)	
	n	**%**	**n**	**%**
Household size				
1 Person	557	20.7	84	23.9
2 Persons	673	25.1	87	24.7
3 Persons	442	16.5	50	14.2
4 Persons	507	18.9	59	16.8
5+ Persons	506	18.8	72	20.5
Car ownership				
0	914	34	128	36.4
1	1367	50.9	187	53.1
2	360	13.4	35	9.9
3	33	1.2	2	0.6
4+	11	0.4	-	-0

Table 38: Socioeconomic characteristics of individuals (Brussels & Brussels City) – Source: OVG 2021

Socioeconomic Characteristics of Individuals

	Brussels		LL Location (Brussels City)	
	N	**%**	**n**	**%**
Gender				
Male	1234	46.1	179	51.3
Female	1443	53.9	170	48.7
Age Category (y.o.)				
6 – 11	259	9.6	36	10.2
12 – 17	232	8.6	26	7.4
18 – 24	201	7.5	23	6.5
25 – 34	460	17.1	80	22.7
35 – 44	440	16.4	70	19.9
45 – 54	380	14.2	45	12.8
55 – 64	304	11.3	37	10.5
65+	409	15.2	35	9.9

The descriptive statistical analysis provides a valuable perspective on the demographic characteristics of the Brussels and Brussels City populations. With respect to car ownership, the majority of households in both regions possess at least one car. The Brussels sample reveals a slight preponderance of female representation, while the Brussels City sample shows a more balanced gender distribution, with males and females represented equally. With respect to age, individuals older than 25 years old are more represented in the sample of both regions. However, the OVG survey lacks variables related to occupation type and income, a limitation that would enhance the results.

6.3.Modal split

Figure 38 illustrates the modal split by trip purpose for Brussels. For commuters, public transportation is the predominant mode of transportation, followed by walking and driving. For educational-related trips, public transportation emerges as the predominant mode of transportation, followed by walking. Conversely, shopping trips are predominantly undertaken by walking, though car use and public transportation also emerge as popular modes. In regard to leisure trips, walking emerges as the predominant mode. The analysis indicates a preference among Brussels residents for walking and public transportation when undertaking daily commutes. Additionally, bicycle usage is not as prevalent in Brussels.

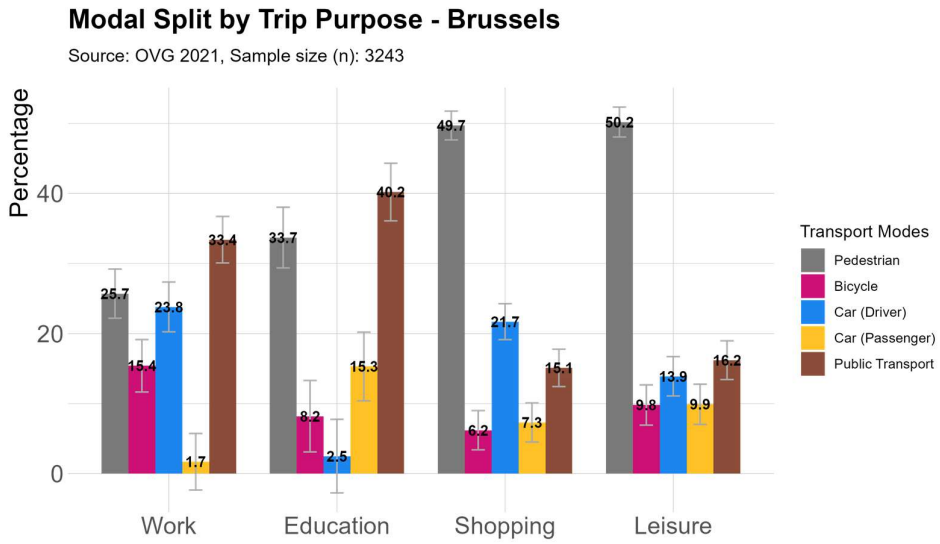


Figure 38: Modal split by trip purpose – Brussels

An analysis of the modal split in the Brussels City area reveals that there are no notable disparities when compared with the modal split of Brussels itself. According to the results illustrated in Figure 39, walking and public transport are the dominant modes for all trip categories, while the utilisation of bicycles remains low in preference. However, a decline in car usage is evident for work- and shopping-related trips, suggesting that the residents of the Brussels City area are able to satisfy their daily needs through the utilisation of more sustainable transportation modes.

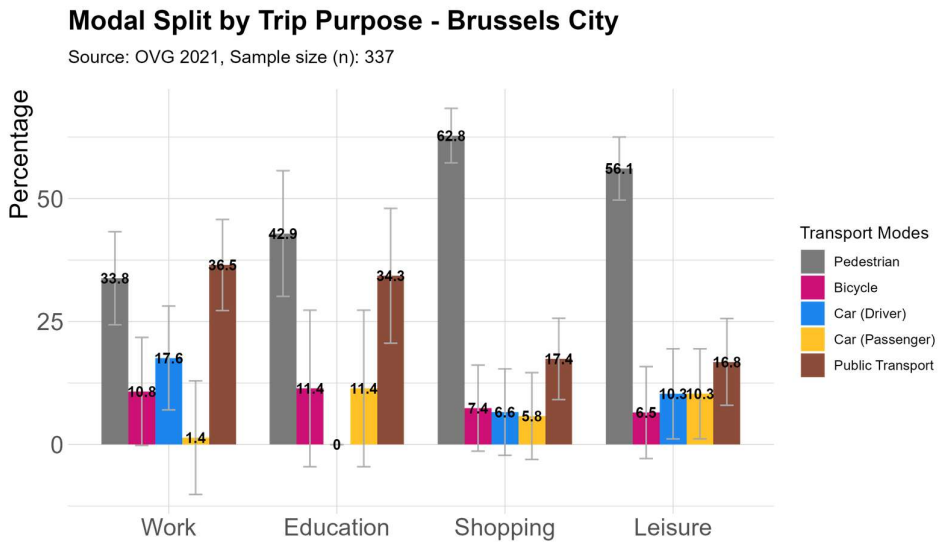
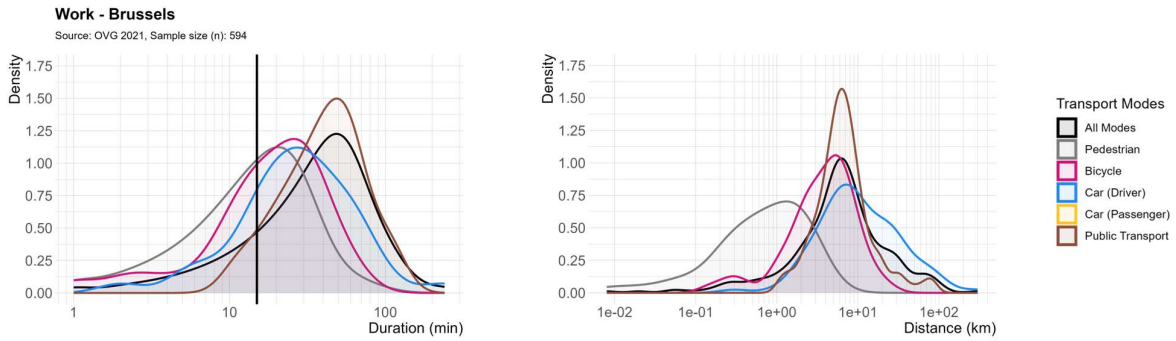


Figure 39: Modal split by trip purpose – Brussels City

6.4.Trip Characteristics – Brussels

6.4.1.Work trips

The average commute in Brussels lasts 26 minutes and is 8.5 kilometres long. Table 40 shows that almost 36% of the commutes in Brussels are made in less than 15 minutes. Public transport is the most used travel mode for commuting, with an average commute time of 40 minutes, while only 5% of these commutes are completed in 15 minutes. Walking is also a popular trip mode for commuting to work, with an average duration of 11 minutes, and approximately 80% of these commutes last up to 15 minutes. For car trips, the average duration is approximately 28 minutes, with nearly 24% of these trips lasting up to 15 minutes. This might be attributed to the fact that a high share of work facilities is not located in the city centre, requiring longer commutes.



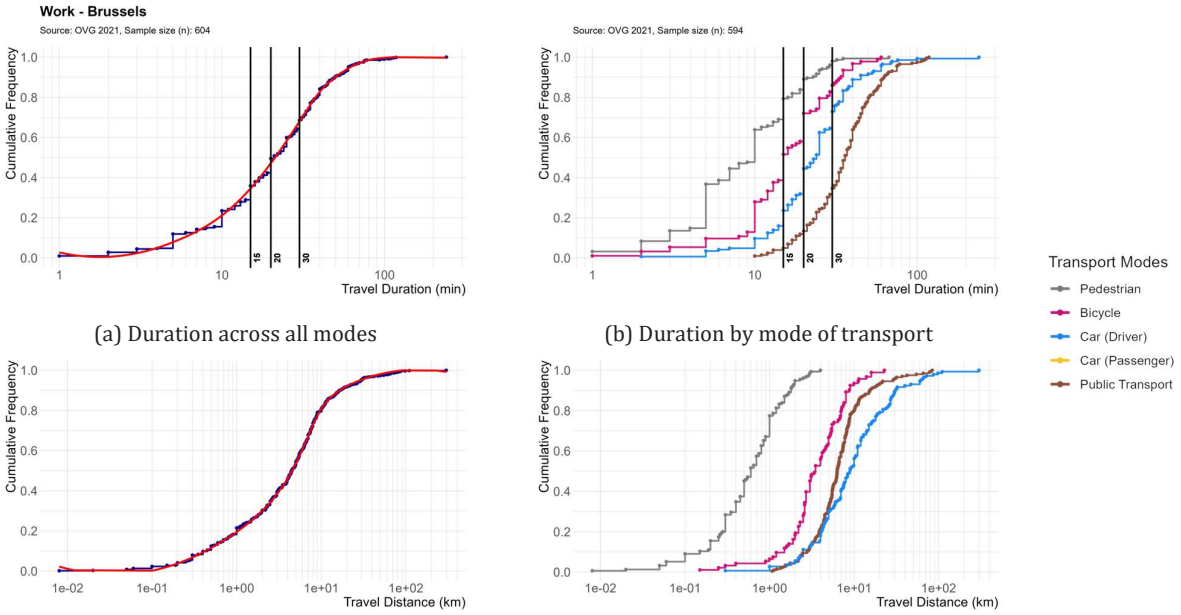
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 40: Density plot of work trip duration (a) and distance (b) by transport mode – Brussels

Table 39: Work trip statistics by transport mode - Brussels

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	604	26.07	21.0	20.86	8.51	4.5	17.65
Pedestrians	155	11.12	10.0	8.86	0.81	0.6	0.71
Bicycle	93	18.58	15.0	11.32	4.70	3.5	3.75
Car (as Driver)	144	27.67	24.0	23.38	17.09	9.0	30.07
Car (as Passenger)	Insufficient sample size for analysis						
Public Transport	202	39.56	36.0	19.97	9.28	6.3	11.90



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

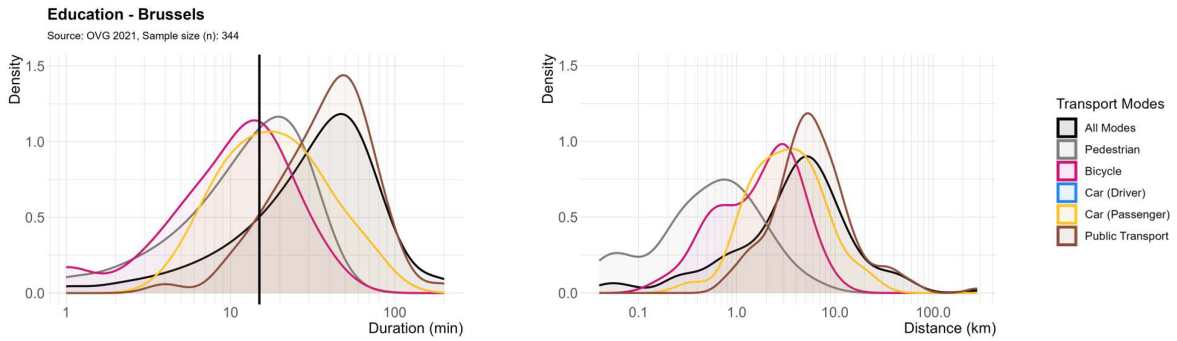
Figure 41: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Brussels

Table 40: Percentage of work trips conducted for different time stamps – Brussels

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	23.5%	35.9%	49.5%	68.5%
Pedestrians	63.9%	79.4%	89.0%	98.1%
Bicycle	28.0%	51.6%	72.0%	86.0%
Car (as Driver)	9.7%	23.6%	44.4%	72.9%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	1.0%	5.0%	13.4%	34.7%

6.4.2. Educational trips

On average, educational trips in Brussels last approximately 24 minutes and are 5.4 kilometres long. In this trip purpose category, almost 50 percent of trips last up to 15 minutes, suggesting a rather high level of proximity to all types of educational institutions. Public transport is the most used mode, followed by walking. Public transport trips have an average duration of 39.2 minutes, while only 10% completed within 15 minutes. Walking trips to educational institutions last on average 11 minutes and 81.5% are completed within 15 minutes. This underscores the accessibility of nearby educational institutions for pedestrians. Cycling trips are similar to walking trips in terms of duration, although they cover longer distances.



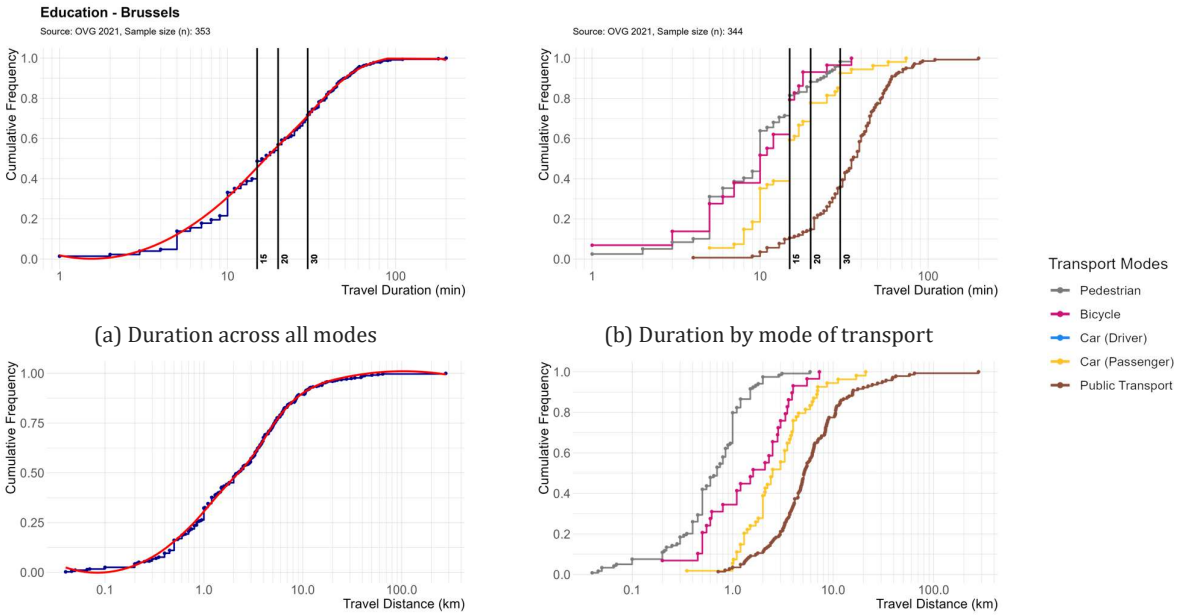
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 42: Density plot of educational trip duration (a) and distance (b) by transport mode – Brussels

Table 41: Educational trip statistics by transport mode - Brussels

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	353	24.2	17.0	22.43	5.44	2.2	16.58
Pedestrians	119	11.2	10.0	7.63	0.82	0.7	0.72
Bicycle	29	11.3	10.0	7.43	2.09	1.6	1.72
Car (as Driver)	Insufficient sample size for analysis						
Car (as Passenger)	54	18.1	15.0	12.84	3.78	2.5	3.74
Public Transport	142	39.2	36.0	23.12	10.10	5.2	24.76



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

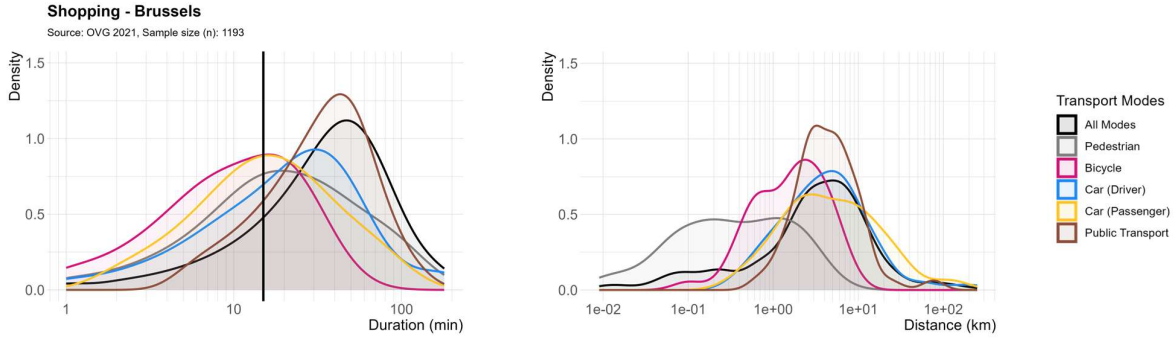
Figure 43: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Brussels

Table 42: Percentage of educational trips conducted for different time stamps – Brussels

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	33.1%	48.7%	56.9%	71.7%
Pedestrians	63.9%	81.5%	88.2%	98.3%
Bicycle	51.7%	79.3%	93.1%	96.6%
Car (as Driver)	Insufficient sample size for analysis			
Car (as Passenger)	35.2%	59.3%	77.8%	92.6%
Public Transport	3.5%	10.6%	14.8%	35.9%

6.4.3. Shopping trips

Shopping trips in Brussels last on average 15.4 minutes, with almost 70% of them lasting up to 15 minutes, indicating a high degree of proximity to shopping facilities. The most preferred mode of transport for shopping is walking, followed by the car and then public transport. On average, Brussels' residents walk 11 minutes walking to go shopping. Moreover, 84% of these walking trips last less than 15 minutes. Shopping trips made by car are slightly longer on average than walking trips, although they cover much longer distances. Trips made by public transport are the longest on average (30 minutes), although only a small percentage (19%) of them last up to 15 minutes.



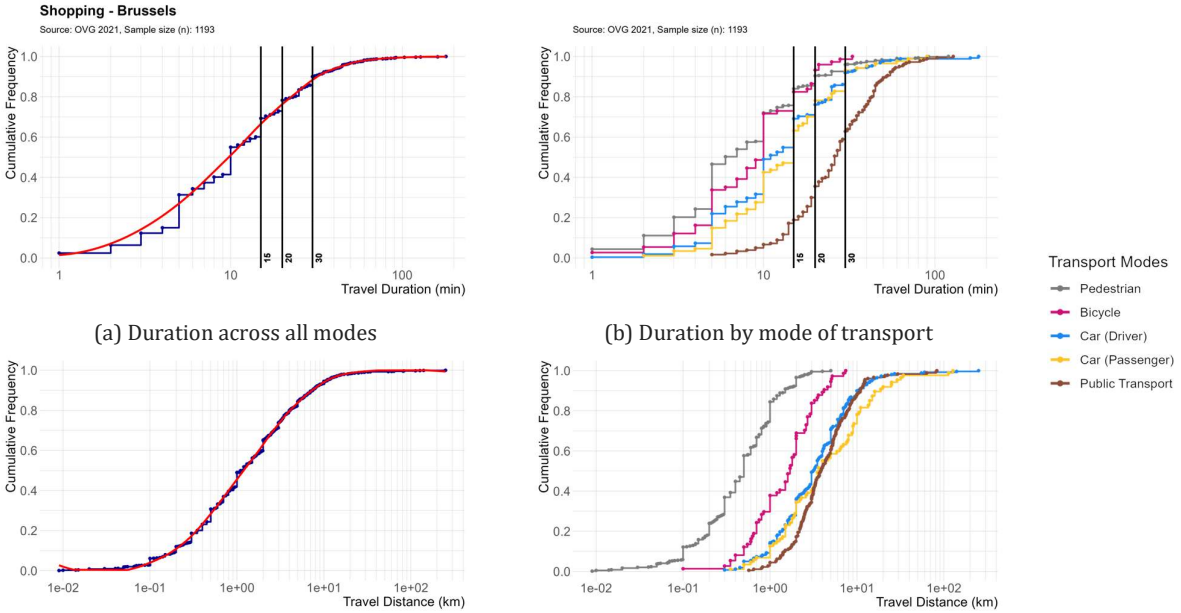
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 44: Density plot of shopping trip duration (a) and distance (b) by transport mode – Brussels

Table 43: Shopping trip statistics by transport mode - Brussels

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	1193	15.41	10.0	16.78	3.47	1.2	11.12
Pedestrians	593	10.68	6.0	12.45	0.68	0.5	0.66
Bicycle	74	10.20	10.0	6.67	1.99	1.7	1.55
Car (as Driver)	259	16.81	11.0	20.35	6.38	3.2	18.47
Car (as Passenger)	87	17.01	15.0	14.21	9.38	3.6	18.59
Public Transport	180	30.34	26.0	18.36	6.24	3.9	10.01



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

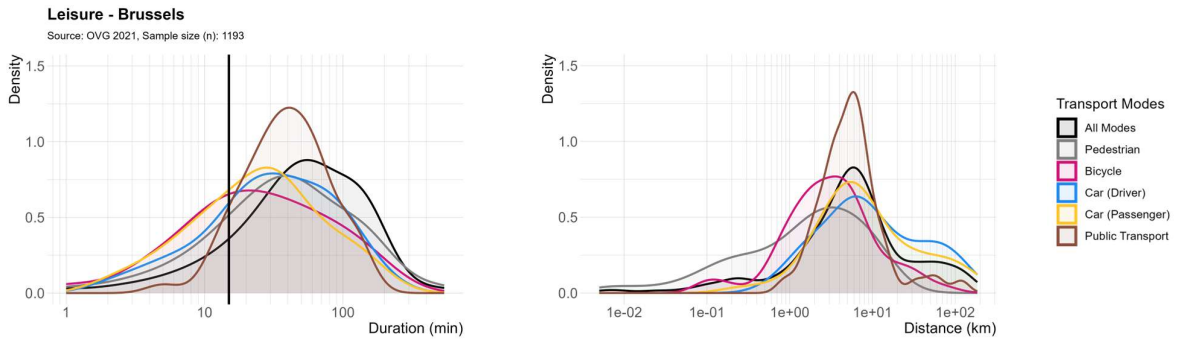
Figure 45: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Brussels

Table 44: Percentage of shopping trips conducted for different time stamps – Brussels

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	55.0%	69.3%	78.3%	90.0%
Pedestrians	72.0%	84.0%	90.4%	96.0%
Bicycle	71.6%	82.4%	93.2%	98.6%
Car (as Driver)	49.0%	69.1%	76.1%	91.9%
Car (as Passenger)	42.5%	63.2%	78.2%	93.1%
Public Transport	6.7%	18.9%	35.6%	62.8%

6.4.4. Leisure trips

Brussels' residents travel on average 31 minutes to reach a leisure facility, while covering almost 7.4 kilometres. In general, leisure trips in Brussels are long lasting, however, according to Table 46, 42.5% of them are completed within 15 minutes. Walking is the most used mode for leisure trips, followed by public transport and car (as driver). On average, walking trips are short in distance (1.9 kilometres) but long in duration (29.7 minutes), with 50% of them lasting up to 15 minutes. Moreover, the high standard deviation for trip duration may indicate that Brussels' residents may prefer walking as a leisure activity in itself. Cycling trips last on average 27 minutes but cover longer distances. The car is also a popular transport mode in this trip category for longer distances. The high standard deviation in the sample indicates that the car is used for both short and long leisure trips by Brussels' residents and more than 40% of them are completed within 15 minutes. Finally, trips made by public transport are on average the longest (37.6 minutes) and cover shorter distances than those made by car. Therefore, a rather small proportion (8.5%) of these trips last up to 15 minutes.



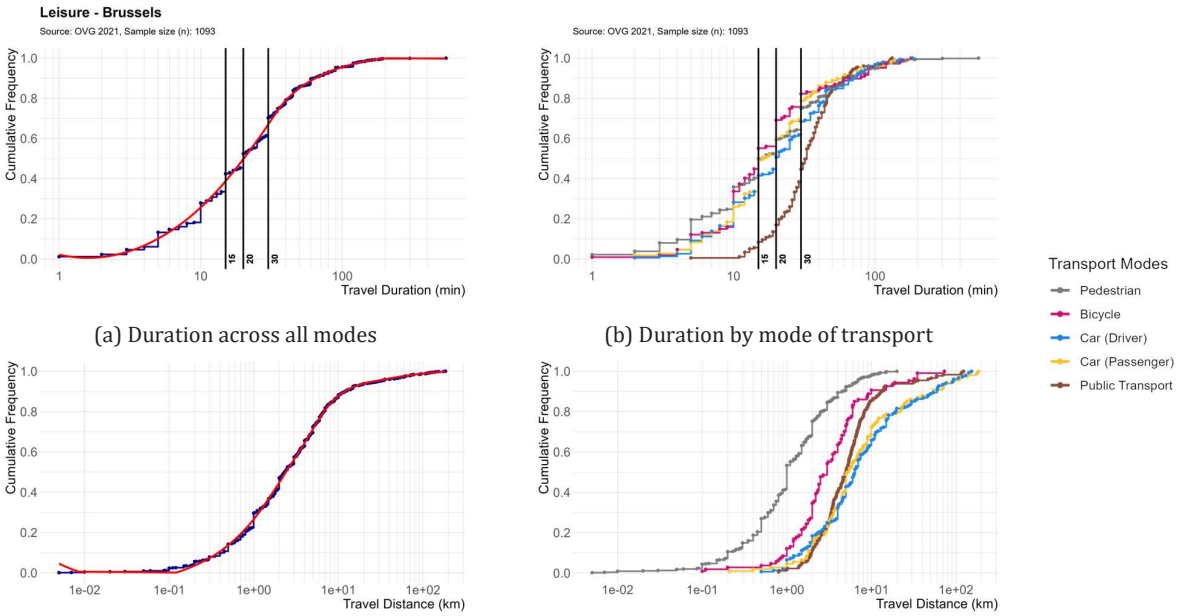
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 46: Density plot of leisure trip duration (a) and distance (b) by transport mode – Brussels

Table 45: Leisure trip statistics by transport mode - Brussels

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	1093	30.58	20	35.71	7.37	2.4	18.52
Pedestrians	549	29.66	16.0	41.57	1.91	1.0	2.44
Bicycle	107	27.23	15.0	33.37	5.79	3.0	9.64
Car (as Driver)	152	30.72	20.0	30.08	18.19	6.4	30.11
Car (as Passenger)	108	26.93	16.5	29.33	18.34	5.4	33.84
Public Transport	177	37.56	33.0	22.27	9.25	5.1	17.51



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 47: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Brussels

Table 46: Percentage of leisure trips conducted for different time stamps – Brussels

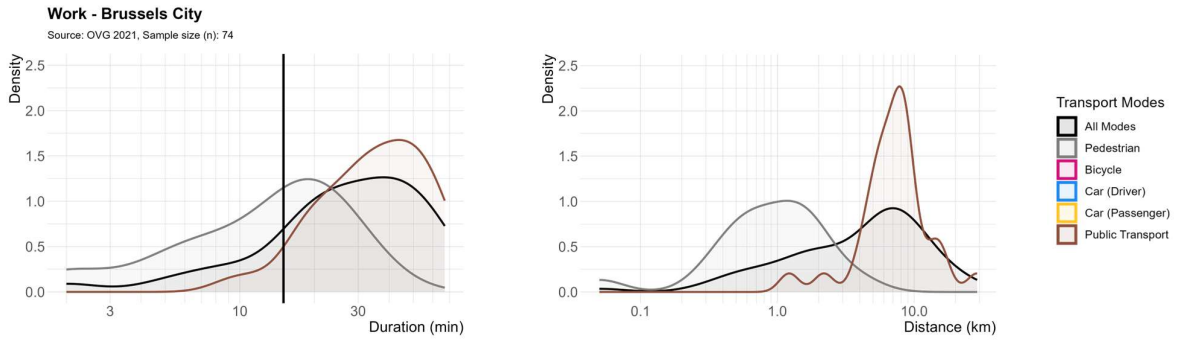
Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	27.9%	42.5%	52.4%	70.3%
Pedestrians	35.9%	49.9%	59.6%	75.0%
Bicycle	33.6%	55.1%	69.2%	82.2%
Car (as Driver)	28.3%	41.4%	50.7%	68.4%
Car (as Passenger)	25.9%	49.1%	60.2%	78.7%
Public Transport	1.0%	8.5%	16.9%	44.6%

6.5.Trip Characteristics – Brussels City

The survey used for this analysis includes a limited number of trips made by residents of Brussels City. For greater accuracy and to avoid misleading results, we analyse the trip characteristics of travel modes with more than 20 entries in the sample. However, the sample size of the general statistics presented in the following tables, includes all the travel modes represented in the sample, irrespective of their number of entries only.

6.5.1.Work trips

Commuting to work in Brussels City region last approximately 25 minutes. There is less variability in the duration of work-related trips than in Brussels as a whole. This indicates that the residents of Brussels city work closer to their home location, which is also supported by the shorter average trip length (5.45 kilometres). However, the proportion of trips completed within 15 minutes is almost 30%, which is lower that the proportion calculated for the commuting trips in the wider Brussels region (36%). Public transport and walking are the most commonly used modes for commuting, but unfortunately the insufficient sample size does not allow us to gain valuable insights into the use of other modes. Trips made by public transport last on average 37 minutes and according to Table 48, only 3.7% of them last up to 15 minutes. The average duration of walking trips is 14.4 minutes, while 60% of them are completed within 15 minutes.



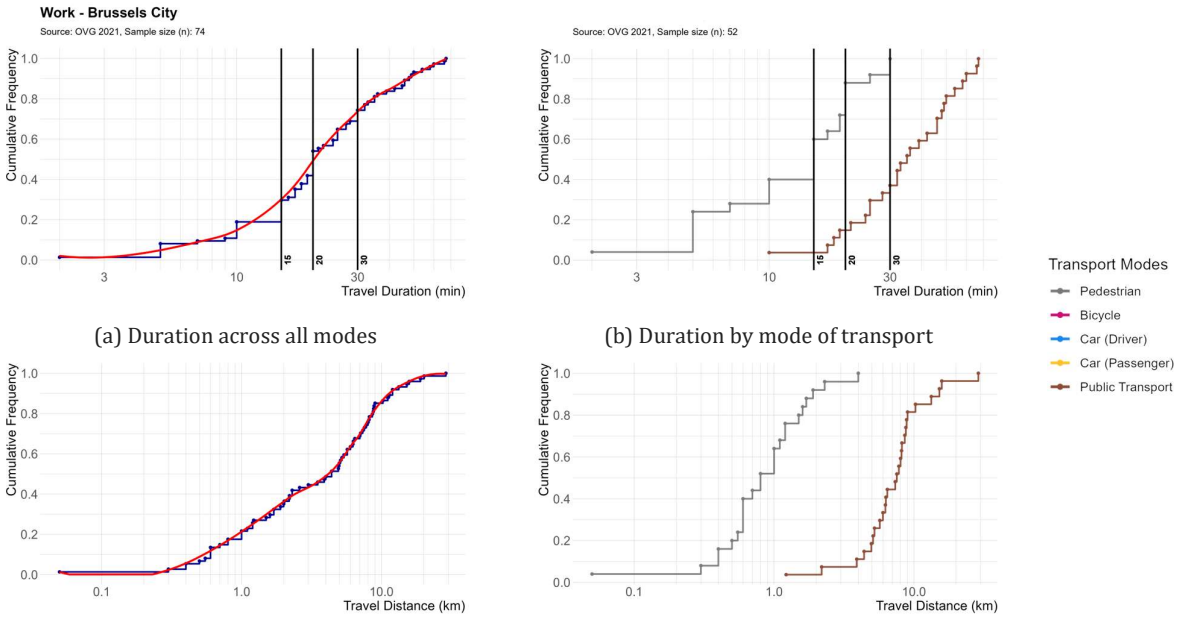
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 48: Density plot of work trip duration (a) and distance (b) by transport mode – Brussels City

Table 47: Work trip statistics by transport mode – Brussels City

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	74	24.72	20.0	15.12	5.45	4.4	5.36
Pedestrians	25	14.36	15.0	7.86	1.06	0.8	0.82
Bicycle	Insufficient sample size for analysis						
Car (as Driver)							
Car (as Passenger)							
Public Transport	27	37.41	35.0	15.63	8.27	7.5	5.32



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

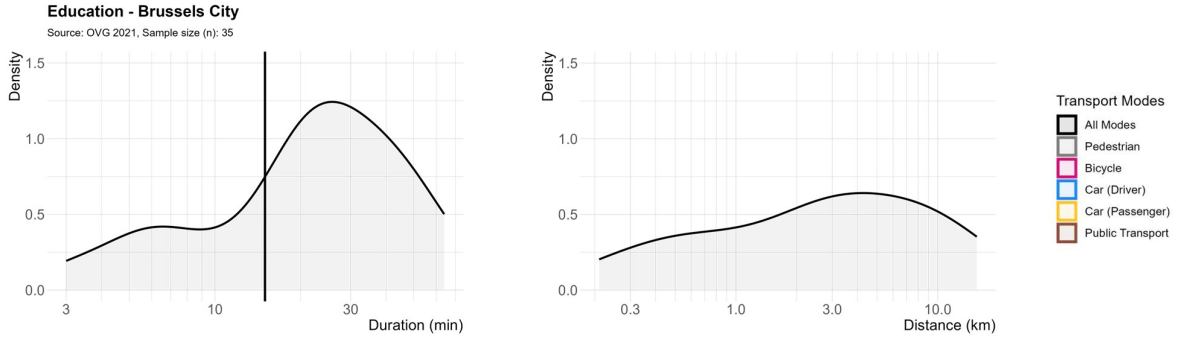
Figure 49: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Brussels City

Table 48: Percentage of work trips conducted for different time stamps – Brussels City

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	18.9%	29.7%	54.1%	74.3%
Pedestrians	40.0%	60.0%	88.0%	100.0%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)				
Car (as Passenger)				
Public Transport	3.7%	3.7%	14.8%	37.0%

6.5.2. Educational trips

Residents of Brussels City region travel on average 21 minutes to reach an educational institution. Moreover, Table 50 shows that almost 49% of these trips last up to 15 minutes. This figure indicates a high degree of proximity to educational institutions in Brussels City region. Due to the limited sample size the analysis does not allow us to draw conclusions on the use of specific modes of transport.



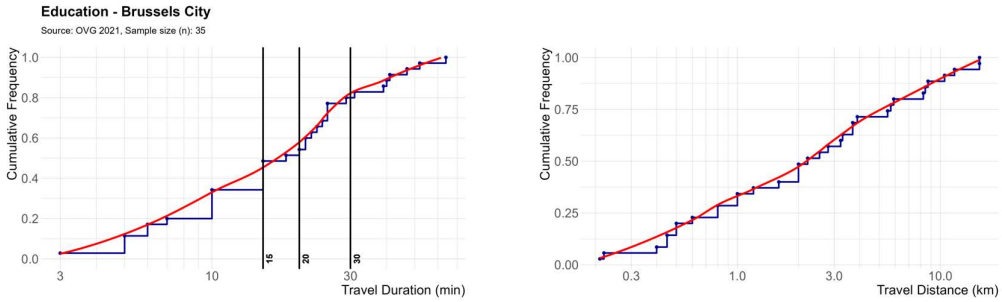
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 50: Density plot of educational trip duration (a) and distance (b) by transport mode – Brussels City

Table 49: Educational trip statistics by transport mode – Brussels City

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	35	20.83	18.0	14.68	3.92	2.22	4.25
Pedestrians	Insufficient sample size for analysis						
Bicycle							
Car (as Driver)							
Car (as Passenger)							
Public Transport							



(a) Duration across all modes

(b) Distance across all modes

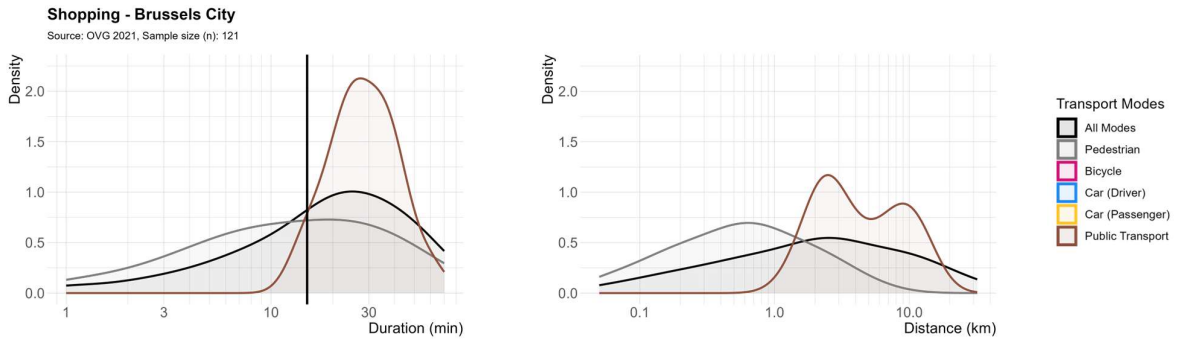
Figure 51: Cumulative distribution function (CDF) of educational trip duration (a) and distance (b)– Brussels City

Table 50: Percentage of educational trips conducted for different time stamps – Brussels City

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	34.3%	48.6%	54.3%	80.0%
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)				
Car (as Passenger)				
Public Transport				

6.5.3. Shopping trips

On average, shopping trips in Brussels city region last approximately 17 minutes and cover almost 2.9 kilometres. Walking is the predominant mode of transport for shopping related trips. Walking trips are short and a large proportion of them (80%) are competed within 15 minutes, showing that individuals are able to satisfy most of their shopping needs locally. Shopping trips made by public transport are much longer than walking trips, both in terms of distance and time. Overall, the results show that shopping trips in Brussels city region are undertaken by sustainable travel modes like walking and public transport, indicating a high degree of proximity to shopping facilities

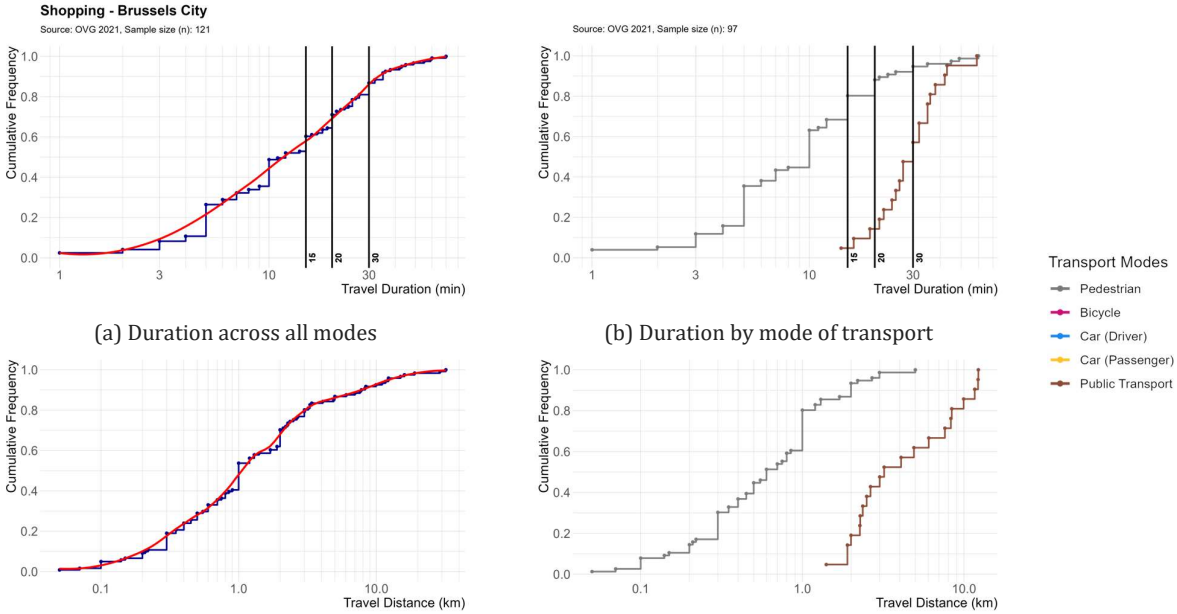


(a) Duration by mode of transport (b) Distance by mode of transport

Figure 52: Density plot of shopping trip duration (a) and distance (b) by transport mode – Brussels City

Table 51: Shopping trip statistics by transport mode – Brussels City

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	121	16.65	12.0	13.81	2.87	1.0	5.01
Pedestrians	76	12.04	10.0	10.84	0.86	0.6	0.83
Bicycle	Insufficient sample size for analysis						
Car (as Driver)							
Car (as Passenger)							
Public Transport	21	30.14	30.0	10.31	5.28	3.2	3.78



(a) Duration across all modes (b) Duration by mode of transport

(c) Distance across all modes (d) Distance by mode of transport

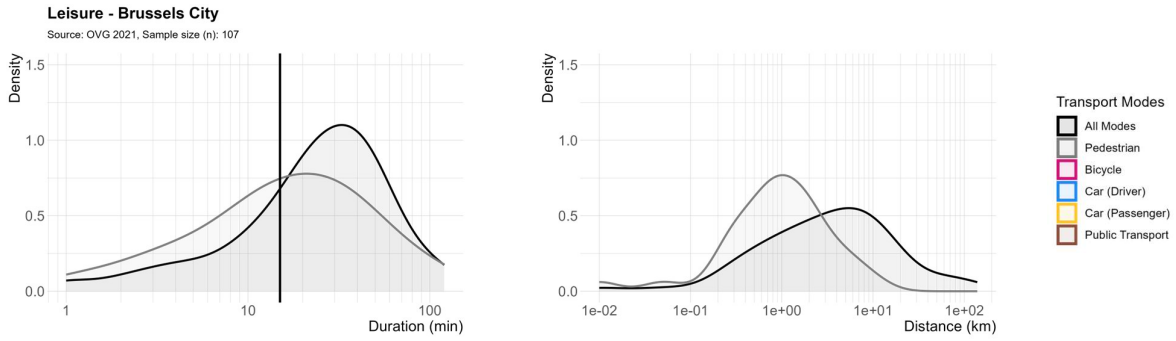
Figure 53: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Brussels City

Table 52: Percentage of shopping trips conducted for different time stamps – Brussels City

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	48.8%	60.3%	71.1%	86.8%
Pedestrians	63.2%	80.3%	88.2%	94.7%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)				
Car (as Passenger)				
Public Transport	-	4.8%	14.3%	57.1%

6.5.4. Leisure trips

The duration of leisure trips in Brussels City last on average 27 minutes, while according to Table 54, 42% of them are completed within 15 minutes. The most frequently utilised mode of transportation for this purpose is walking, with an average duration of 20 minutes and a distance covered of 1.3 kilometres. In comparison to leisure trips undertaken by foot in Brussels, those in this area are shorter on average, indicating a high level of accessibility to leisure facilities in the area. Unfortunately, the findings of the analysis are limited due to an inadequate sample size.



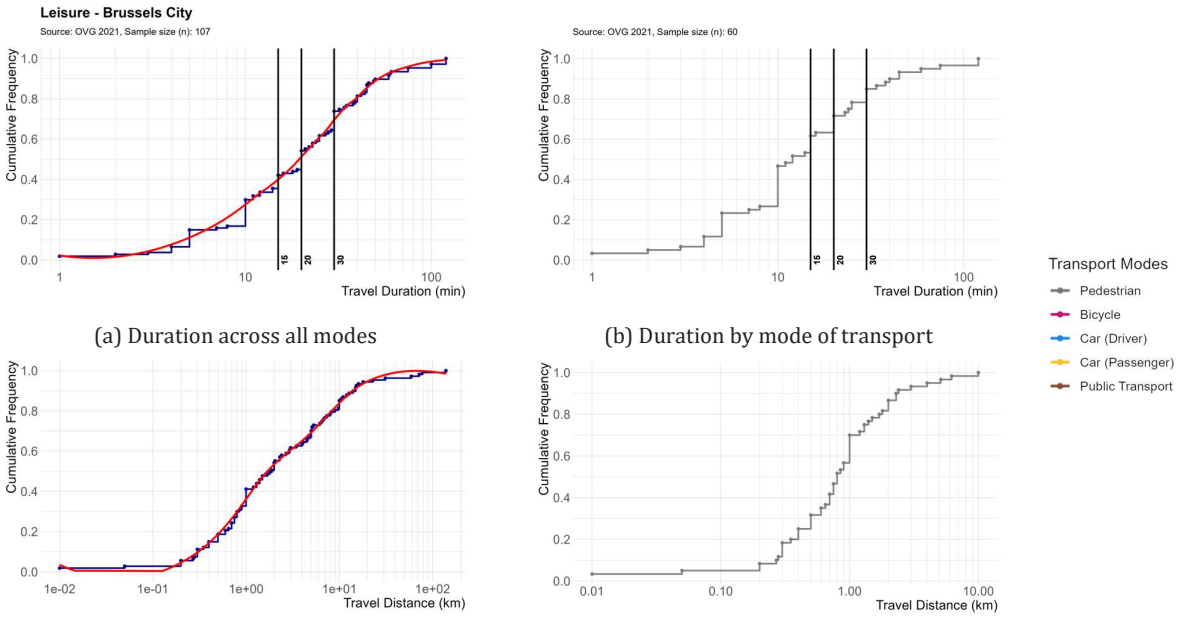
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 54: Density plot of leisure trip duration (a) and distance (b) by transport mode – Brussels City

Table 53: Leisure trip statistics by transport mode – Brussels City

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	107	26.93	20.0	24.99	7.26	1.9	17.71
Pedestrians	60	20.37	12.0	23.56	1.28	0.8	1.62
Bicycle	Insufficient sample size for analysis						
Car (as Driver)							
Car (as Passenger)							
Public Transport							



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 55: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Brussels City

Table 54: Percentage of leisure trips conducted for different time stamps – Brussels City

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	29.9%	42.1%	54.2%	73.8%
Pedestrians	46.7%	61.7%	71.7%	85.0%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)				
Car (as Passenger)				
Public Transport				

6.6.Travel behaviour across different socioeconomic groups

The present section of the analysis is concerned with an examination of modal split and trip characteristics of different socioeconomic groups in Brussels. The main findings of the analysis are presented here, but the detailed results of the analysis can be found in **Appendix C** and **G**.

6.6.1.Gender

- Work, education, and shopping trips show no significant gender differences in travel behaviour.
- Leisure trips are significantly longer for males, both in terms of distance and time travelled.
- Women rely more on public transport across all trip purposes compared to men.
- Men use bicycles more than women, especially for leisure and shopping trips.
- Car mode is more dominant among men for work and shopping trips.
- Pedestrian travel is slightly more common among women, especially for education and leisure trips.

6.6.2.Age

In order to analyse travel behaviour by age in Brussels, the sample has been divided into four age groups. The age distribution in each group is differs slightly from the one used for the other cities. This is due to

the fact that the dataset is already categorising the respondents in these groups. The groups are the following:

1. Children/Students (up to 17 years old)
2. Young adults (18 to 34 years old)
3. Middle-aged adults (35 to 64 years old)
4. Old adults (over 65 years old)

- Education trips show the strongest variation across age groups, with young adults traveling significantly longer distances.
- Leisure trips are significantly longer for older adults, indicating a shift in travel patterns.
- Work and shopping trips show no significant variation across age groups.
- Variability in travel times increases with age, especially for education and leisure trips.

7. BUDAPEST

7.1.General characteristics of Budapest and LL location

Budapest is the capital of Hungary and consists of 23 districts. With approximately 1.685 million inhabitants (7), it is the largest city in Hungary. Budapest has an efficient and public transport network that includes underground lines, tram, trolleybuses, and suburban railway lines. It also offers car and micromobility sharing services.

The Budapest Living Lab is located in the 17th district of Budapest called Rákosmente. Rákosmente is a suburban district of Budapest in the eastern part of the city, and has a population of about 90,000 ihabitants. In Rákosmente, people rely heavily on private car use, while the frequency of public transport is low.

Figure 56 shows the map of Budapest and the location of the Rákosmente district.

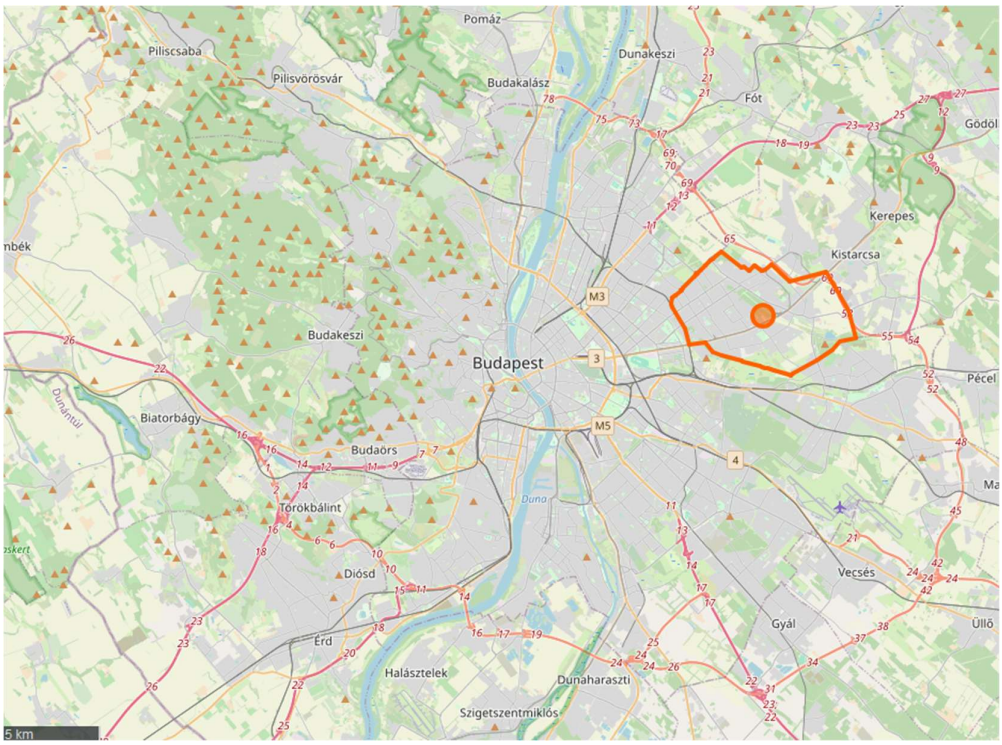


Figure 56: Location of the Rákosmente district (orange line) (Source: OSM (2024))

7.2.Descriptive statistical analysis

For the descriptive statistical analysis for the city of Budapest and the Budapest's LL region the dataset "Household Survey for Unified Macroscopic Transport Model 2019" (8) was used. A list of socioeconomic variables, both for households and individuals, was selected and presented in Tables Table 55 and Table 56 respectively.

It is important to acknowledge the limitations imposed by the relatively modest sample size of trips made by residents of the Rákosmente region. This limits the scope and generalisability of the results of the analysis. In order to address these limitations, a comprehensive analysis of the 16th and 17th districts is carried out. The 16th district of Budapest is located next to the 17th district of Budapest (Rákosmente) and shares common socio-economic and travel characteristics.

The sample used for this part of the analysis is the *total resident population* within the area (Budapest or Budapest's LL region), with no filtering for specific trip purposes. Furthermore, the sample of survey

respondents who did not provide a valid response to one or more of the selected questions was excluded from the sample.

Table 55: Socioeconomic characteristics of households (Budapest & Budapest LL location) – Source: HSUMTM 2019

Socioeconomic Characteristics of Households

	Budapest		LL Location (16th & 17th District)	
	n	%	n	%
Household size				
1 Person	1307	38	101	28.5
2 Persons	988	28.7	100	28.2
3 Persons	604	17.6	77	21.7
4+ Persons	540	15.7	77	21.7
Economic situation				
Less than 50.000 Ft	19	0.8	14	4.5
50.001 - 100.000 Ft	163	7	17	5.5
100.001 - 150.000 Ft	647	27.9	54	17.4
150.001 - 250.000 Ft	982	42.3	185	59.5
250.001 - 350.000 Ft	338	14.6	31	10
350.001 - 450.000 Ft	108	4.7	8	2.6
More than 450.000 Ft	64	2.8	2	0.6
Car ownership				
0	1240	36.1	171	48.2
1	1781	51.8	162	45.6
2	396	11.5	21	5.9
3	19	0.6	1	0.3
Bike availability				
0	2047	59.5	242	68.2
1	814	23.7	58	16.3
2	380	11.0	27	7.6
3	124	3.6	14	3.9
3+	74	2.2	14	3.9

Table 56: Socioeconomic characteristics of individuals (Budapest & Budapest LL location) – Source: HSUMTUM 2019

Socioeconomic Characteristics of Individuals

	Budapest		LL Location (16th & 17th District)	
	n	%	n	%
Gender				
Male	2123	61.7	242	68.2
Female	1316	38.3	113	31.8
Age Category (y.o.)				
6 – 14	-	-	-	-
15 – 19	10	0.3	-	-
20 – 24	106	3.1	1	0.3
25 – 34	563	16.4	29	8.2
35 – 44	783	22.8	73	20.6
45 – 54	795	23.1	74	20.8
55 – 64	543	15.8	82	23.1
65+	639	18.6	96	27
Occupation				
Employed	2733	79.5	321	90.4
Student	-	-	-	-
Pensioner	675	19.6	34	9.6
Other	31	0.9	-	-
Car Driving License				
No	1035	30.1	160	45.1
Yes	2404	69.9	195	54.9

The descriptive statistical analysis provides a detailed overview of the demographic profile of residents in Budapest and the Budapest LL region. With respect to gender, males are overrepresented in the sample. However, it is evident that the gender distribution within the sample deviates from the official statistics of Budapest. According to the statistics provided by the Hungarian Central Statistical Office (9) for the year of 2019, males represented 47% of the total population of Budapest. With regard to age, the sample is predominantly composed of individuals over the age of 25, and especially of people in the age group 34 to 54 years old. n relation to the subjects' occupations, the sample consists primarily of those currently in employment and retired individuals, as well as those in receipt of a state pension. It is noteworthy that the sample is lacking in students, a phenomenon that is also associated with the age distribution of the sample. Concerning the availability of bicycles, it is observed that many households in Budapest do not possess a bicycle, in contrast to the prevalence of car ownership, where over 60% of households own at least one car.

7.3.Modal split

As demonstrated in Figure 57, the modal split results for the city of Budapest reveal that the majority of commuters utilise private vehicles and public transport. This trend extends to educational trips as well, however, the limited number of educational trips included in the dataset may have influenced the analysis' outcomes. In contrast, when it comes to shopping and leisure trips, walking emerges as the predominant mode, followed by driving and public transport. Notably, bicycle usage remains minimal in Budapest.

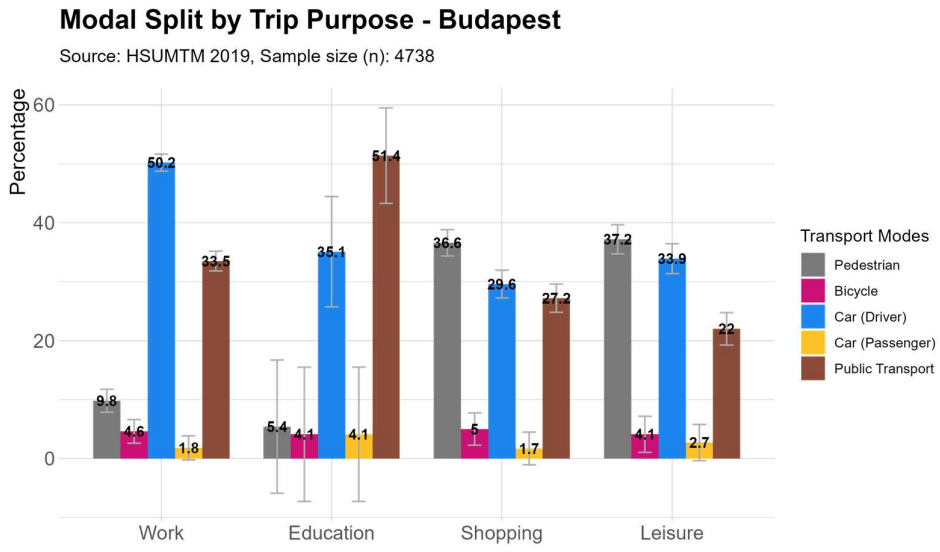


Figure 57: Modal split by trip purpose – Budapest

The results of the modal split analysis in the 16th and 17th District of Budapest, as presented in Figure 58, indicate a preference for driving and public transport, particularly for shopping and work-related trips. Furthermore, it is observed that leisure trips are predominantly undertaken by car, on foot, and by public transport, which mirrors the modal split observed in Budapest. However, an increase in car usage is observed in shopping and leisure trips, while a decrease is observed for work-related trips. It is also noted that bicycle usage remains low. Moreover, the lack of data from educational trips limits the analysis of the modal split for this trip category.

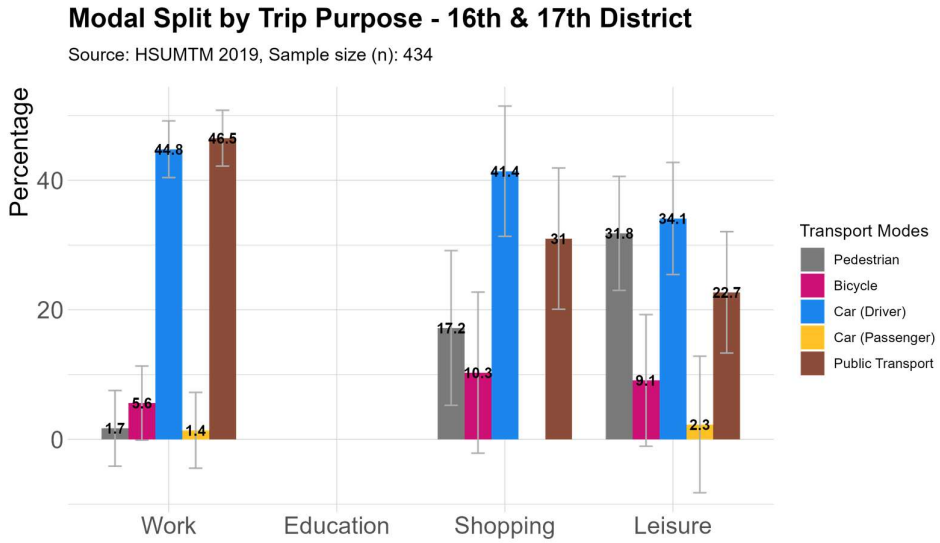


Figure 58: Modal split by trip purpose – 16th & 17th District

7.4.Trip Characteristics – Budapest

7.4.1.Work trips

In Budapest, the average commute lasts approximately 36 minutes, while only the 17.4% of these trips are completed within 15 minutes. The high standard deviation (SD) suggests considerable variability in the sample, indicating that some trips are considerably longer or shorter than the average. The majority of the work-related trips in Budapest are made by car. The average duration of these journeys is 36 minutes, with only 12.3% of trips lasting up to 15 minutes. This suggests a limited level of proximity to work-related facilities, particularly for those who opt for sustainable transportation modes. Additionally, commutes undertaken by public transport are prevalent, though they tend to be significantly longer than those made by car. Furthermore, only the 4.4% of these commutes are completed within 15 minutes. Consequently, the analysis indicates a high degree of car dependency among individuals in Budapest, which contributes to the overall length of commutes.

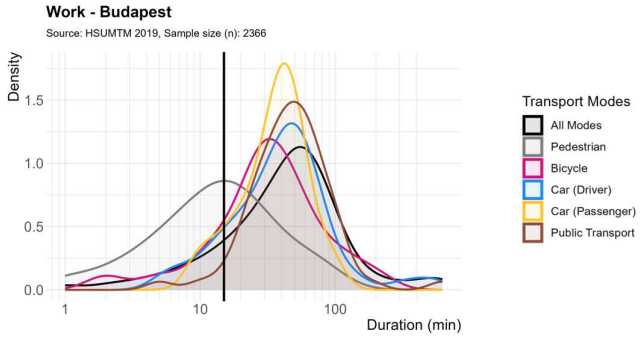
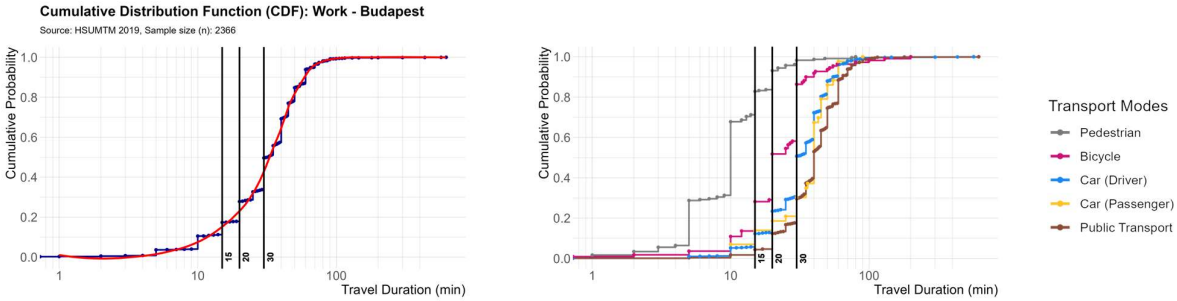


Figure 59: Density plot of work trip duration by transport mode – Budapest

Table 57: Work trip statistics by transport mode – Budapest

Transport Modes	Sample (n)	Duration (min)		
		Mean	Median	SD
All Modes	2366	35.88	32.0	26.90
Pedestrians	233	11.74	10.0	9.18
Bicycle	110	27.12	20.0	23.77
Car (as Driver)	1187	35.91	30.0	26.23
Car (as Passenger)	43	38.23	40.0	15.94
Public Transport	793	44.01	40.0	27.67



(a) Duration across all modes (b) Duration by mode of transport

Figure 60: Cumulative distribution function (CDF) of work trip duration– Budapest

Table 58: Percentage of work trips conducted for different time stamps – Budapest

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	10.5%	17.4%	27.8%	49.6%
Pedestrians	67.8%	82.8%	93.1%	98.3%
Bicycle	10.9%	28.2%	51.8%	86.4%
Car (as Driver)	5.2%	12.3%	23.4%	50.7%
Car (as Passenger)	7.0%	14.0%	18.6%	30.2%
Public Transport	1.8%	4.4%	12.4%	29.6%

7.4.2. Educational trips

The mean duration of educational trips in Budapest is 31.4 minutes, and according to Table 60, almost 22% of these trips are completed within 15 minutes. Public transport is the predominant mode for education-related trips in Budapest, followed by car. Public transport trips last on average 35 minutes, while almost 8% of them last up to 15 minutes. It is important to note that the age group of individuals younger than 19 y.o. is not represented successfully in the sample, therefore, the majority of educational trips in Budapest have as a destination tertiary educational facilities. The results indicate an overall low level of proximity to educational institutions in Budapest. This has resulted in a shift away from more sustainable means of transport like walking or cycling.

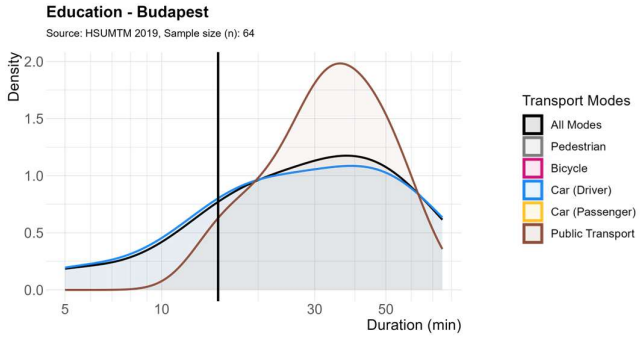
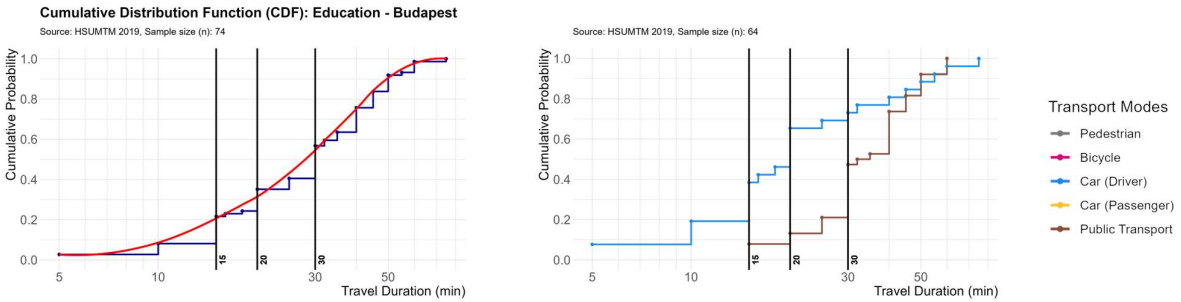


Figure 61: Density plot of educational trip duration by transport mode – Budapest

Table 59: Educational trip statistics by transport mode – Budapest

Transport Modes	Sample (n)	Duration (min)		
		Mean	Median	SD
All Modes	74	31.39	30.0	15.34
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)	26	25.42	20.0	18.08
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	38	35.84	33.5	12.14



(a) Duration across all modes (b) Duration by mode of transport

Figure 62: Cumulative distribution function (CDF) of educational trip duration– Budapest

Table 60: Percentage of educational trips conducted for different time stamps – Budapest

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	8.1%	21.6%	35.1%	56.8%
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)	19.2%	38.5%	65.4%	73.1%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport		7.9%	13.2%	47.4%

7.4.3. Shopping trips

Shopping trips in Budapest last on average 20 minutes, while 55% of them are completed within 15 minutes. The most used transport mode for shopping-related trips in Budapest is walking, followed by car and public transport. According to the results presented in Table 61 and Table 62, walking trips to shopping facilities last on average 11.8 minutes and almost 82% of them last up to 15 minutes. In addition, car journeys to shopping facilities are on average longer than walking journeys, and the high variance in the sample shows that car journeys are preferred for shopping destinations that are far from home and that may offer a wide variety of products. The same applies to shopping trips made by public transport. However, only 24% of public transport trips are completed within 15 minutes, compared to 48% of car trips. Overall, individuals in Budapest are choosing more sustainable modes of transport to meet their daily shopping needs, a finding that indicates a good level of proximity to shopping facilities.

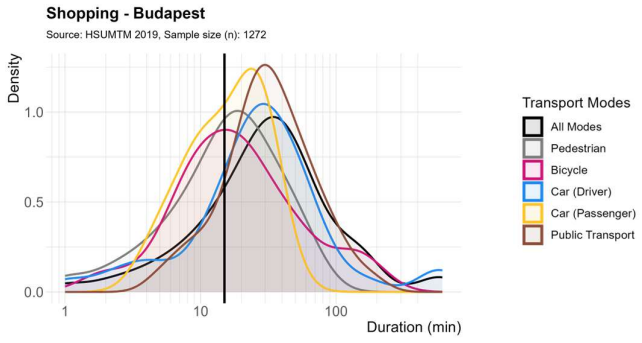
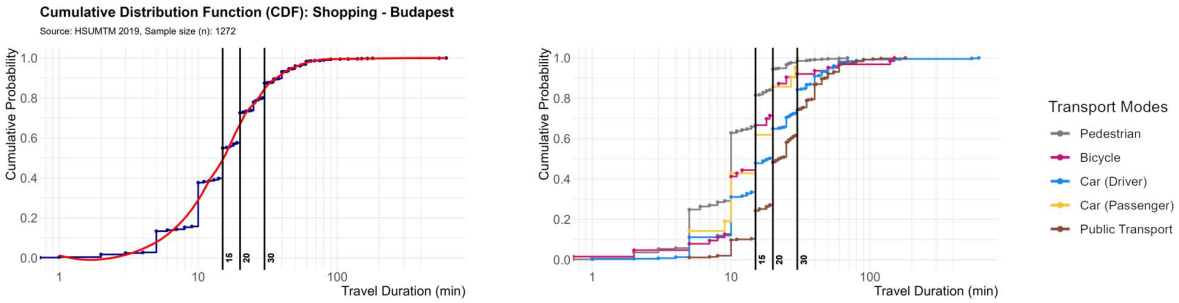


Figure 63: Density plot of shopping trip duration by transport mode – Budapest

Table 61: Shopping trip statistics by transport mode – Budapest

Transport Modes	Sample (n)	Duration (min)		
		Mean	Median	SD
All Modes	1272	20.36	15.0	27.33
Pedestrians	466	11.79	10.0	7.48
Bicycle	63	19.49	15.0	24.94
Car (as Driver)	376	24.43	19.0	43.49
Car (as Passenger)	21	15.24	15.0	7.58
Public Transport	346	27.94	22.5	18.14



(a) Duration across all modes

(b) Duration by mode of transport

Figure 64: Cumulative distribution function (CDF) of shopping trip duration– Budapest

Table 62: Percentage of shopping trips conducted for different time stamps – Budapest

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	37.7%	55.0%	72.6%	87.4%
Pedestrians	62.9%	81.5%	94.4%	98.5%
Bicycle	41.3%	66.7%	85.7%	92.1%
Car (as Driver)	31.1%	47.9%	64.9%	84.3%
Car (as Passenger)	42.9%	61.9%	85.7%	100.0%
Public Transport	9.8%	24.3%	48.3%	74.3%

7.4.4. Leisure

The duration of leisure trips in Budapest is on average 25 minutes, with 47% of these trips being completed within 15 minutes. The predominant mode of transportation for this purpose is walking, followed by car and public transport. On average, walking trips are rather short in duration (12.7 minutes), and according to Table 64, a high share of them (82.2%) last up to 15 minutes. Trips made by car and public transport last on average more than 32 minutes. However, the high standard deviation observed in the sample indicates significant variability. The findings indicate that pedestrians and cyclists in Budapest predominantly engage in shorter recreational trips, while motorized modes are associated with longer duration.

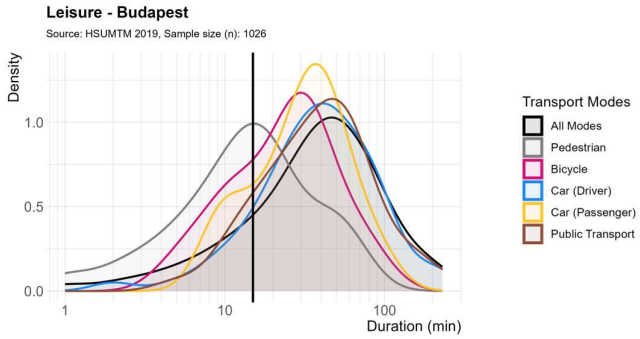
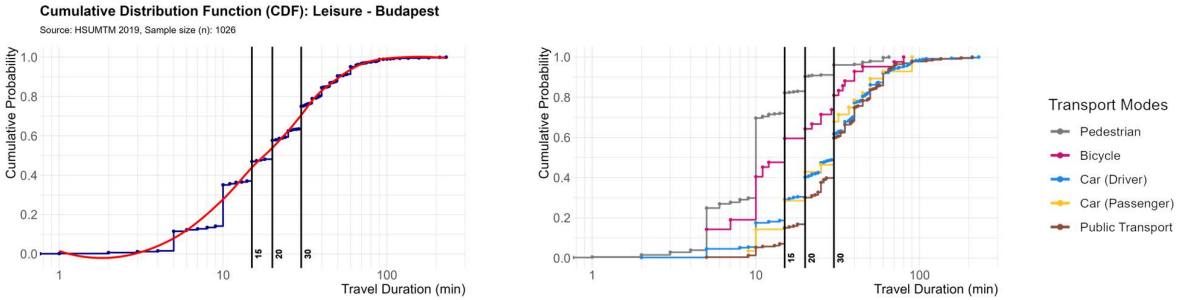


Figure 65: Density plot of leisure trip duration by transport mode – Budapest

Table 63: Leisure trip statistics by transport mode – Budapest

Transport Modes	Sample (n)	Duration (min)		
		Mean	Median	SD
All Modes	1026	25.22	20.0	22.87
Pedestrians	382	12.68	10.0	10.48
Bicycle	42	20.23	15.0	16.72
Car (as Driver)	348	32.44	30.0	25.78
Car (as Passenger)	28	31.36	30.0	21.25
Public Transport	226	35.46	30.0	24.57



(a) Duration across all modes (b) Duration by mode of transport

Figure 66: Cumulative distribution function (CDF) of leisure trip duration– Budapest

Table 64: Percentage of leisure trips conducted for different time stamps – Budapest

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	35.1%	47.0%	57.7%	75.0%
Pedestrians	69.6%	82.2%	90.3%	96.1%
Bicycle	40.5%	59.5%	64.3%	81.0%
Car (as Driver)	17.5%	29.0%	40.2%	61.8%
Car (as Passenger)	14.3%	28.6%	42.9%	67.9%
Public Transport	5.3%	15.0%	30.1%	59.7%

7.5.Trip Characteristics – 16th and 17th district

The survey used for this analysis includes a limited number of trips made by residents of Budapest's Living Lab location. For greater accuracy and to avoid misleading results, we analyse the trip characteristics of travel modes with more than 20 entries in the sample. However, the sample size of the general statistics presented in the following tables, includes all the travel modes represented in the sample, irrespective of their number of entries only.

7.5.1.Work trips

The mean duration of commuting trips in the 16th and 17th district of Budapest is 38 minutes, with a proportion of 4.9% of these commutes being completed 15 minutes. Public transport is the dominant mode in this category, followed by car. It is evident that residents of the Budapest LL region allocate a significant portion of their time to commuting, relying heavily on motorized transportation. The low proportion of work-related trips completed within 15 minutes is indicative of the limited degree of proximity to work facilities. The analysis is further constrained by the limited availability of data concerning trips undertaken by walking, cycling, and as a passenger in a car, which limits the scope and reliability of the results.

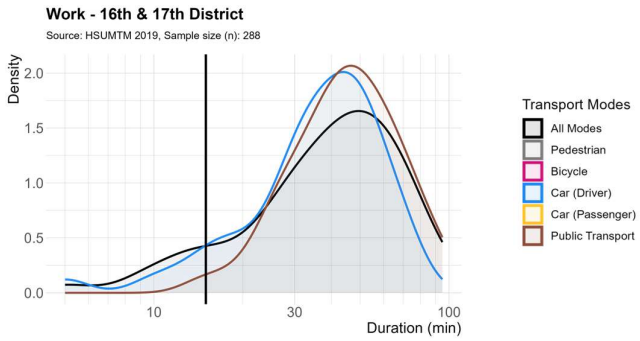
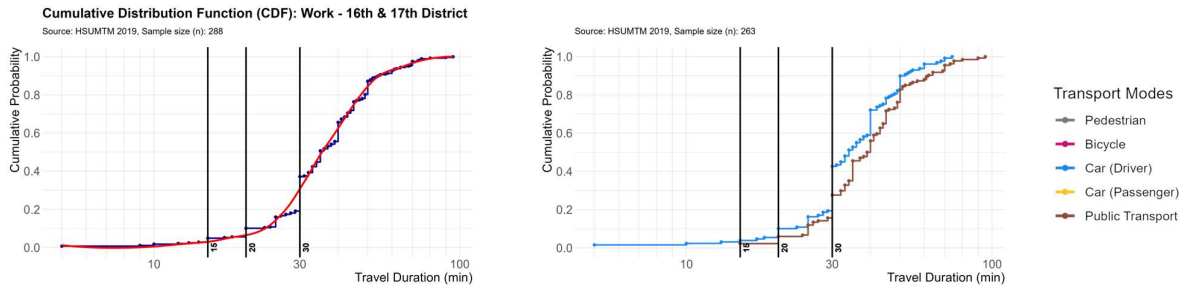


Figure 67: Density plot of work trip duration by transport mode – 16th & 17th District

Table 65: Work trip statistics by transport mode – 16th & 17th District

Transport Modes	Sample (n)	Duration (min)		
		Mean	Median	SD
All Modes	288	38.06	35.0	14.16
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)	129	36.53	34.0	12.75
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	134	41.15	39.5	14.91



(a) Duration across all modes

(b) Duration by mode of transport

Figure 68: Cumulative distribution function (CDF) of work trip duration– 16th & 17th District

Table 66: Percentage of work trips conducted for different time stamps – 16th & 17th District

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	1.7%	4.9%	10.1%	37.2%
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)	2.3%	3.9%	10.1%	42.6%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	-	2.2%	6.0%	27.6%

7.5.2. Educational trips

The dataset "Household Survey for Unified Macroscopic Transport Model 2019" does not contain a sufficient sample size (less than 20 entries) of educational trips in the 16th and 17th districts of Budapest Therefore, as the analysis cannot provide us with valuable insights into the travel behavior related to educational trips of the residents of these districts, this part of the analysis is skipped.

7.5.3. Shopping trips

The mean duration of shopping trips in the 16th and 17th district of Budapest is 22 minutes, and almost 45% of these trips are completed within 15 minutes. Residents of the Budapest Living Lab region allocate a greater proportion of their time to reaching a shopping location than those residing in the broader area of Budapest. The analysis indicates that the car is the predominant mode for shopping-related trips, suggesting a high degree of dependency on motorized transport. However, the analysis is constrained by the limited number of trips undertaken by other travel modes, which limits the results of the analysis.

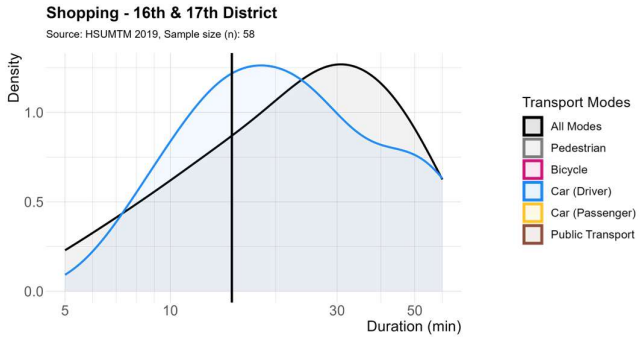
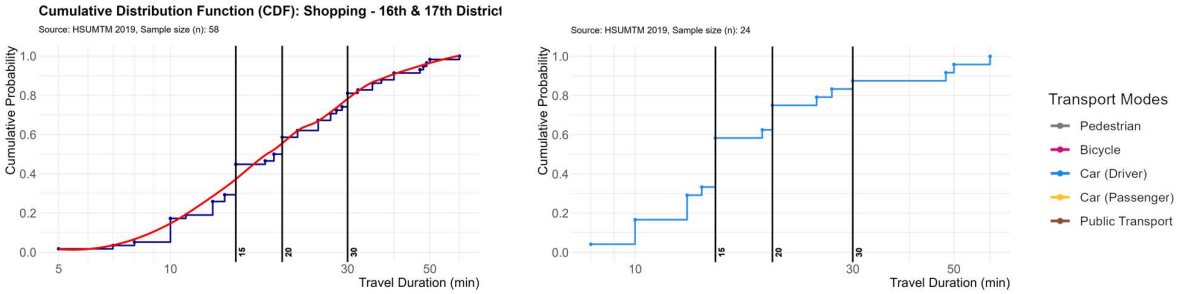


Figure 69: Density plot of shopping trip duration by transport mode – 16th & 17th District

Table 67: Shopping trip statistics by transport mode – 16th & 17th District

Transport Modes	Sample (n)	Duration (min)		
		Mean	Median	SD
All Modes	58	22.33	19.5	12.40
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)	24	20.83	15.0	13.54
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport				



(a) Duration across all modes (b) Duration by mode of transport

Figure 70: Cumulative distribution function (CDF) of shopping trip duration– 16th & 17th District

Table 68: Percentage of shopping trips conducted for different time stamps – 16th & 17th District

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	17.2%	44.8%	58.6%	81.0%
Pedestrians	Insufficient sample size for analysis			
Bicycle				
Car (as Driver)	16.7%	58.3%	75.0%	87.5%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport				

7.5.4. Leisure trips

The mean duration of recreational trips in the 16th and 17th districts of Budapest is approximately 27 minutes. Furthermore, it is notable that 37.5% of leisure trips are completed within 15 minutes. The most prevalent travel modes are the car, walking and public transport. According to Table 76, the average duration of walking trips is 12 minutes, with 75% of them lasting up to 15 minutes. In contrast, leisure trips undertaken by car and public transport are characterised by a significantly longer duration. The results indicate a high degree of reliance on motorized transport for leisure-related trips, coupled with a limited proximity to leisure facilities, thereby contributing to extended travel times.

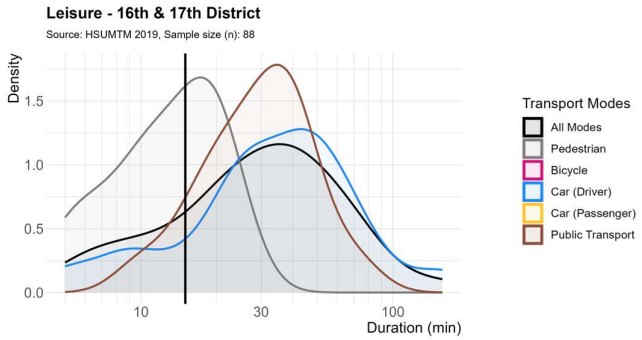
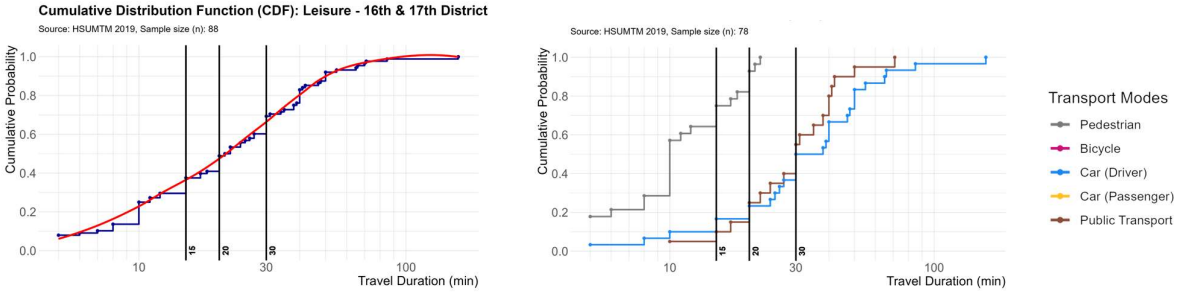


Figure 71: Density plot of leisure trip duration by transport mode – 16th & 17th District

Table 69: Leisure trip statistics by transport mode – 16th & 17th District

Transport Modes	Sample (n)	Duration (min)		
		Mean	Median	SD
All Modes	88	27.24	21.5	22.41
Pedestrians	28	11.89	10.0	5.47
Bicycle	Insufficient sample size for analysis			
Car (as Driver)	30	39.50	34.0	28.83
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	20	31.65	30.0	13.93



(a) Duration across all modes

(b) Duration by mode of transport

Figure 72: Cumulative distribution function (CDF) of leisure trip duration– 16th & 17th District

Table 70: Percentage of leisure trips conducted for different time stamps – 16th & 17th District

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	25.0%	37.5%	48.9%	69.3%
Pedestrians	57.1%	75.0%	92.9%	100%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)	10.0%	16.7%	23.3%	50.0%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	5.0%	10.0%	25.0%	55.0%

7.6.Travel behaviour across different socioeconomic groups

The present section of the analysis is concerned with an examination of modal split and trip characteristics of different socioeconomic groups in Budapest. The main findings of the analysis are presented here, but the detailed results of the analysis can be found in **Appendix D** and **G**.

7.6.1.Gender

- No significant gender differences in travel times across all trip purposes.
- Work travel times are highly consistent between genders.
- Females show greater variability in shopping trips.
- Education and leisure trips have slight gender differences, but not statistically significant.
- The utilization of public transport is more prevalent among females than males for all trip purposes, while the converse is true for males, who are more inclined to drive.
- Walking is more prevalent among females than males for shopping and leisure trips.

7.6.2.Age

In order to analyse travel behaviour by age in Budapest, the sample has been divided into three age groups. The age distribution in each group is differs slightly from the one used for the other cities. This is due to the fact that the dataset is already categorising the respondents in these groups, and there are data missing for individuals younger than 18 years old. The groups are the following:

1. Young adults (19 to 39 years old)
2. Middle-aged adults (40 to 59 years old)
3. Old adults (over 60 years old)

- Work travel times are relatively stable across age groups with no significant difference.
- Individuals from all age groups usually drive for work-related trips.
- Middle-aged adults have the longest shopping trips, but with high variability.
- Car is the predominant mode for shopping and leisure trips conducted by middle-aged adults.
- Older adults tend to spend more time on leisure trips, but not significantly.
- Both young and old adults walk more than middle-aged adults when travelling for leisure.

8. ÎLE-DE-FRANCE

8.1. General characteristics of Île-de-France and LL location

Île-de-France region consists of 8 districts (départements) and has over 1,200 municipalities. (10). With more than 12,4 million inhabitants in 2022, it is the most populous region and the most densely populated in France. Île-de-France has a highly developed public transport network consisting of 16 metro lines, regional train lines, tram lines and bus lines.

The Île-de-France Living Lab is centred around the T12 Express tramway corridor, which links several municipalities in the Essonne region. This tramway, which will be inaugurated in 2023, serves around 280,000 inhabitants. The transport network in the Living Lab area already includes improved cycling infrastructure linking the tram line to the surrounding neighbourhoods and regional trains.

Figure 73 shows the map of Île-de-France and the location of the Essonne region.

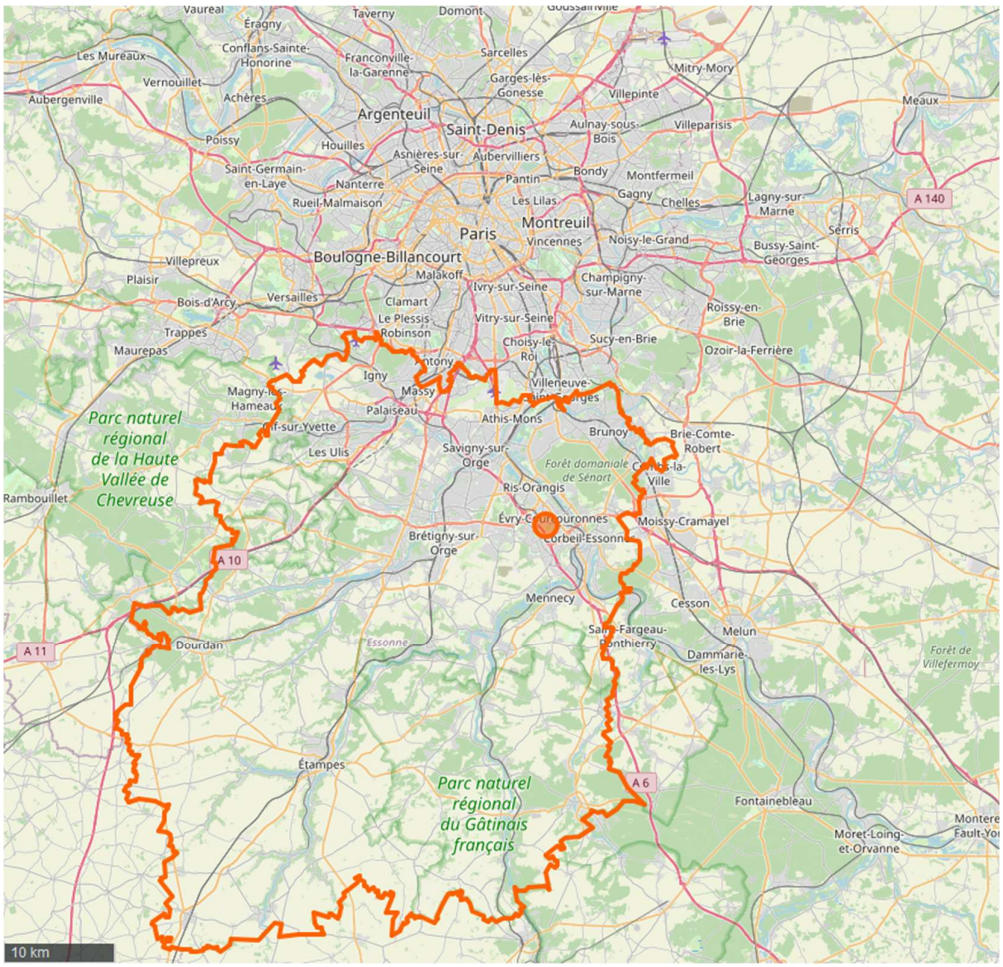


Figure 73: Location of the Essonne district (orange line) (Source: OSM (2024))

8.2.Descriptive statistical analysis

For the descriptive statistical analysis for the Île-de-France region and the Essonne region, the dataset "Enquête Globale Transport (EGT) 2020" (11) was used. A list of socioeconomic variables, both for households and individuals, was selected and presented in Tables Table 71 and Table 72 respectively.

The sample used for this part of the analysis is the *total resident population* within the area (Île-de-France or Essonne), with no filtering for specific trip purposes. Furthermore, the sample of survey respondents who did not provide a valid response to one or more of the selected questions was excluded from the sample.

Table 71: Socioeconomic characteristics of households (Île-de-France & Essonne) – Source: EGT 2020

Socioeconomic Characteristics of Households				
	Île-de-France		LL Location (Essonne)	
	n	%	n	%
Household size				
1 Person	1779	37.3	161	32.0
2 Persons	1512	31.7	168	33.4
3 Persons	602	12.6	75	14.9
4+ Persons	873	18.3	99	19.7
Economic situation				
Less than 800€	87	2.2	8	1.9
From 800 to 1200€	200	5.0	15	3.5
From 1200 to 1600€	324	8.1	32	7.5
From 1600 to 2000€	389	9.8	53	12.5
From 2000 to 2400€	411	10.3	44	10.4
From 2400 to 3000€	491	12.3	55	12.9
From 3000 to 3500€	398	10.0	50	11.8
From 3500 to 4500€	582	14.6	74	17.4
From 4500 to 5500€	414	10.4	37	8.7
5500€ and more	683	17.2	57	13.4
Car ownership				
0	839	19.4	30	6.4
1	2292	53.0	253	54.1
2	1033	23.9	165	35.3
3	140	3.2	18	3.8
4+	20	0.5	2	0.4

Table 72: Socioeconomic characteristics of individuals (Île-de-France & Essonne) – Source: EGT 2020

Socioeconomic Characteristics of Individuals				
	Île-de-France		LL Location (Essonne)	
	n	%	n	%
Gender				
Male	4993	47.7	554	48.2
Female	5477	52.3	596	51.8
Age Category (y.o.)				
6 – 14	1972	18.8	203	17.7
15 – 19	615	5.9	81	7.0
20 – 24	359	3.4	40	3.5
25 – 34	1061	10.1	112	9.7
35 – 44	1462	14.0	142	12.3
45 – 54	1608	15.4	181	15.7
55 – 64	1381	13.2	157	13.7
65+	2012	19.2	234	20.3
Occupation				
Student	2064	22.1	225	22.3
Employed	4433	47.4	463	45.9
Pensioner	2181	23.3	251	24.9
Other	673	7.2	70	6.9
Car driving license				
Yes	6397	79.8	156	17.7
No	1617	20.2	724	82.3

The descriptive statistical analysis provides a comprehensive insight into the demographic characteristics of the inhabitants of Île-de-France and Essonne. Firstly, the sample of women is slightly larger than that of men. In addition, children and older adults are more strongly represented in the sample. Regarding the type of employment, the majority of the sample is employed. In addition, most of

the people in Île-de-France have a driving licence, in contrast to the people in Essonne, where only 17.7% of the inhabitants have a driving licence.

8.3.Modal split

As illustrated in Figure 74, and analysis of the modal split by trip purpose for the Île-de-France region reveals that for commuters, driving is the predominant mode of transportation, followed by public transport and walking. With respect to educational-related trips, walking emerges as the predominant mode of transportation, followed by public transport. In the case of shopping trips, walking is the most prevalent mode, though car use and public transportation also emerge as popular modes. With regard to leisure trips, walking emerges as the predominant mode. The analysis indicates a preference among Île-de-France residents for walking and public transportation when fulfilling daily needs. Furthermore, bicycle usage is not as prevalent in Île-de-France.

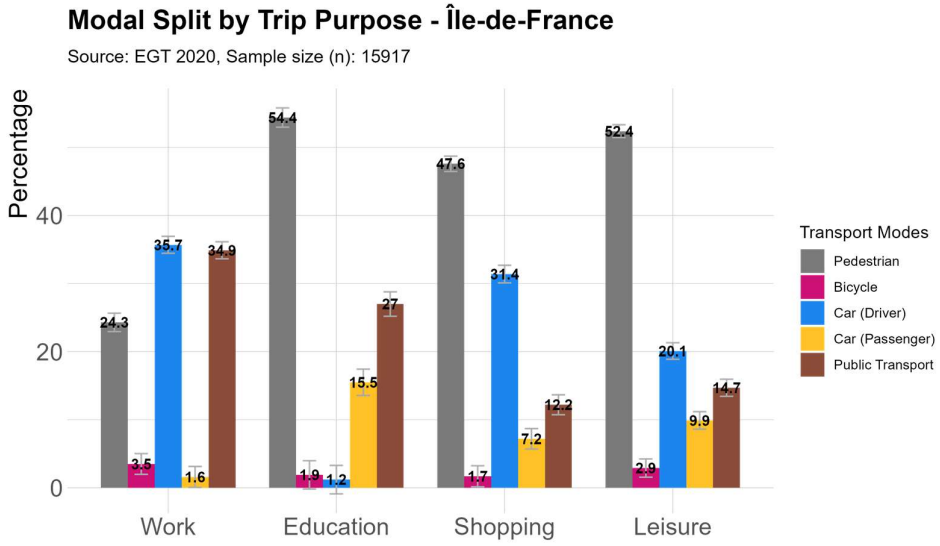


Figure 74: Modal split by trip purpose - Île-de-France

The results of the modal split analysis in the Essonne department, as presented in Figure 75, indicate a clear preference for driving and public transport for work-related trips. A notable increase in the utilisation of cars for daily commutes is observed, accompanied by a decline in walking. A similar trend is observed in the context of shopping, with an increase in car use for this purpose. Leisure trips are predominantly undertaken on foot, and by car, which mirrors the modal split observed in Île-de-France. Additionally, an increase in public transportation usage and car usage (as passenger) is observed for educational trips. It is also noted that bicycle usage remains low. The modal split results in Essonne department indicate a strong reliance on motorized transport, contrasting with the results of Île-de-France modal split.

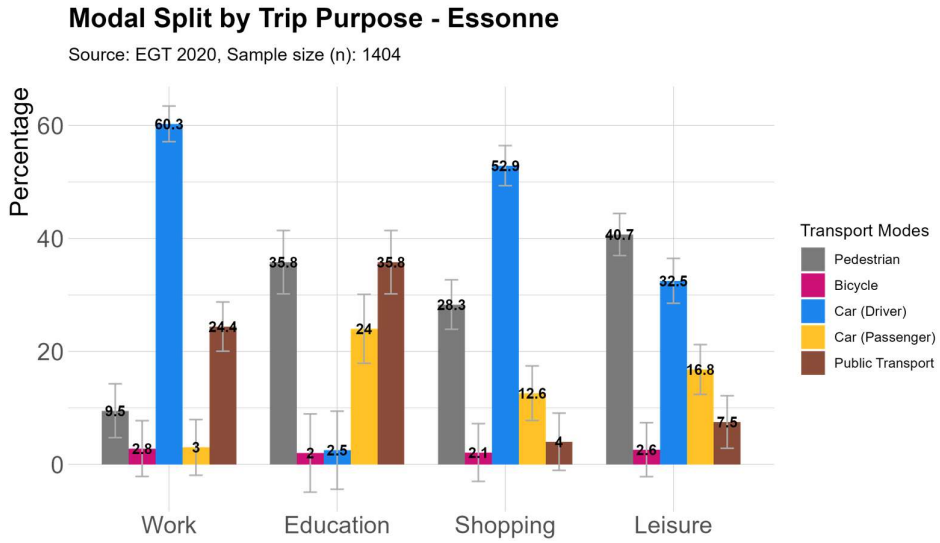
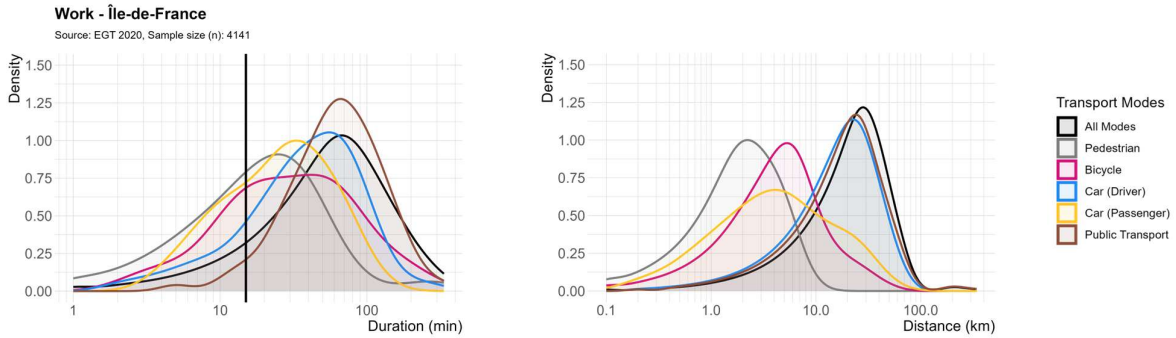


Figure 75: Modal split by trip purpose - Essonne

8.4.Trip Characteristics - Île-de-France

8.4.1.Work trips

The average duration of a work trip in Île-de-France is approximately 34 minutes, with an average distance of 9 kilometres. According to Table 74, nearly 85% of work trips in the region are completed within 15 minutes. Driving is the most prevalent mode for commuting, with an average duration of 32 minutes. However, only 30.8% of these trips last up to 15 minutes. Public transport is also a popular mode of commuting, especially for longer trips, with the average duration of a commute undertaken by public transport being 55 minutes, while covering almost 14 kilometres. This may be attributed to the fact that a significant proportion of Île-de-France residents reside in areas distant from the Paris region, necessitating longer commutes. Finally, walking trips are the shortest both in duration and distance. Despite the high degree of proximity to work-related facilities indicated by the results, residents of the Île-de-France region nevertheless remain highly dependent on motorised transport for their daily commutes.



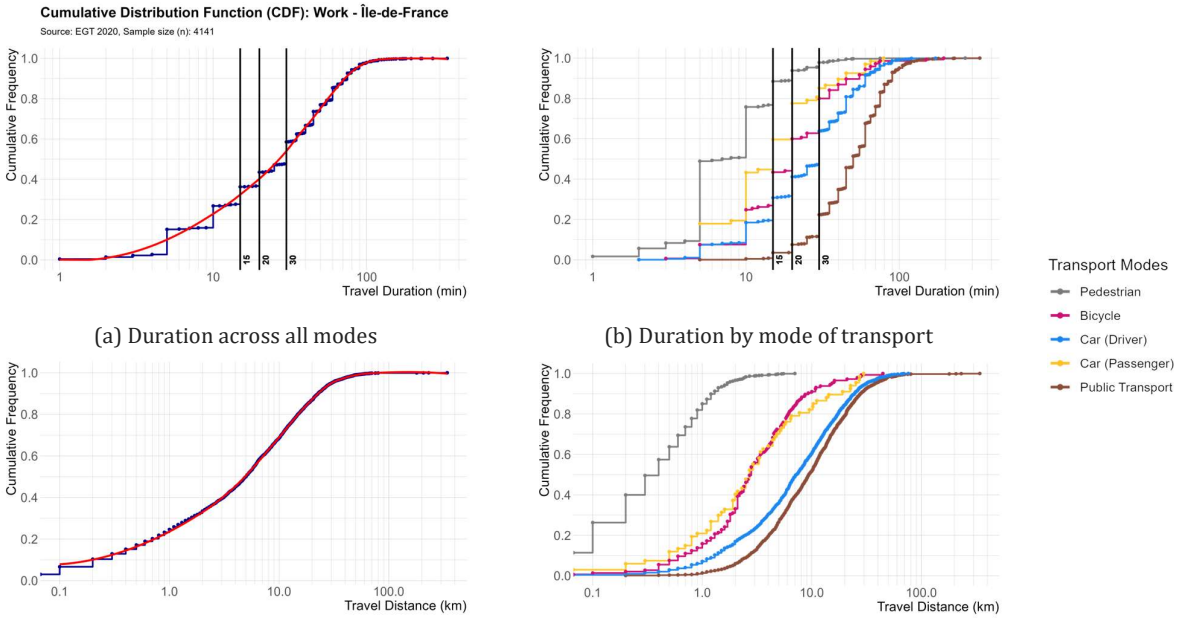
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 76: Density plot of work trip duration (a) and distance (b) by transport mode – Île-de-France

Table 73: Work trip statistics by transport mode – Île-de-France

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	4141	34.19	30.0	28.30	8.99	5.0	13.06
Pedestrians	1008	10.06	7.5	11.40	0.57	0.4	0.69
Bicycle	145	25.83	20.0	23.79	4.61	2.8	5.91
Car (as Driver)	1477	31.69	30.0	22.48	10.76	7.3	10.61
Car (as Passenger)	67	19.42	15.0	16.36	5.63	2.7	7.38
Public Transport	1444	55.10	50.0	27.47	13.66	9.4	17.05



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

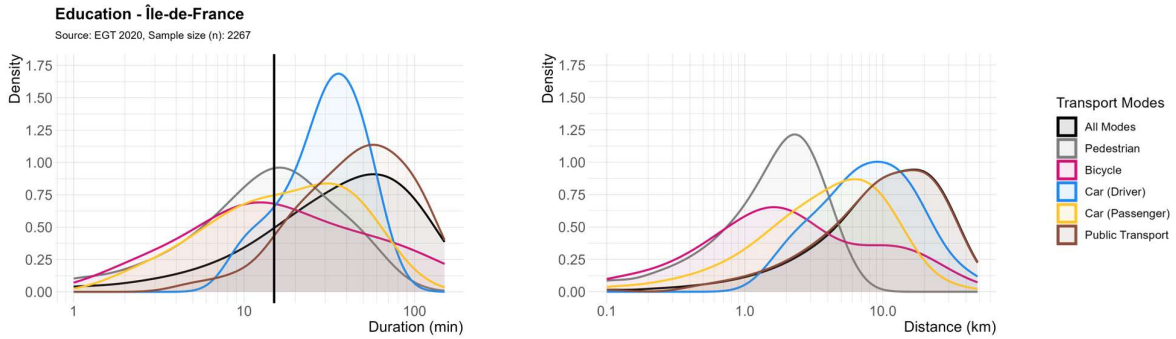
Figure 77: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Île-de-France

Table 74: Percentage of work trips conducted for different time stamps – Île-de-France

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	26.8%	36.2%	43.5%	58.5%
Pedestrians	24.8%	43.4%	60.0%	80.0%
Bicycle	26.8%	36.2%	43.5%	58.5%
Car (as Driver)	18.5%	30.8%	41.2%	63.8%
Car (as Passenger)	43.3%	59.7%	77.6%	85.1%
Public Transport	0.5%	3.5%	7.5%	22.4%

8.4.2. Educational trips

Trips to educational institutions in Île-de-France region last on average 20 minutes, while covering almost 3 kilometres. The results presented in Table 76 indicate a high degree of proximity to educational institutions, since almost 90% of the educational trips reported are completed within 15 minutes. The dominant mode in this trip purpose category is walking, followed by public transport and car (as passenger). Walking trips are the shortest in both duration and distance, and 72% of them last up to 15 minutes. In contrast, public transport trips are the longest, with an average duration of 43 minutes and an average distance of almost 8 kilometres. The predominance of short trips in the Île-de-France region is indicative of a high degree of dependency on motorised transport. This phenomenon may be attributed to the fact that a significant proportion of university students who do not reside in close proximity to Paris, where the majority of universities are located, are compelled to undertake longer journeys.



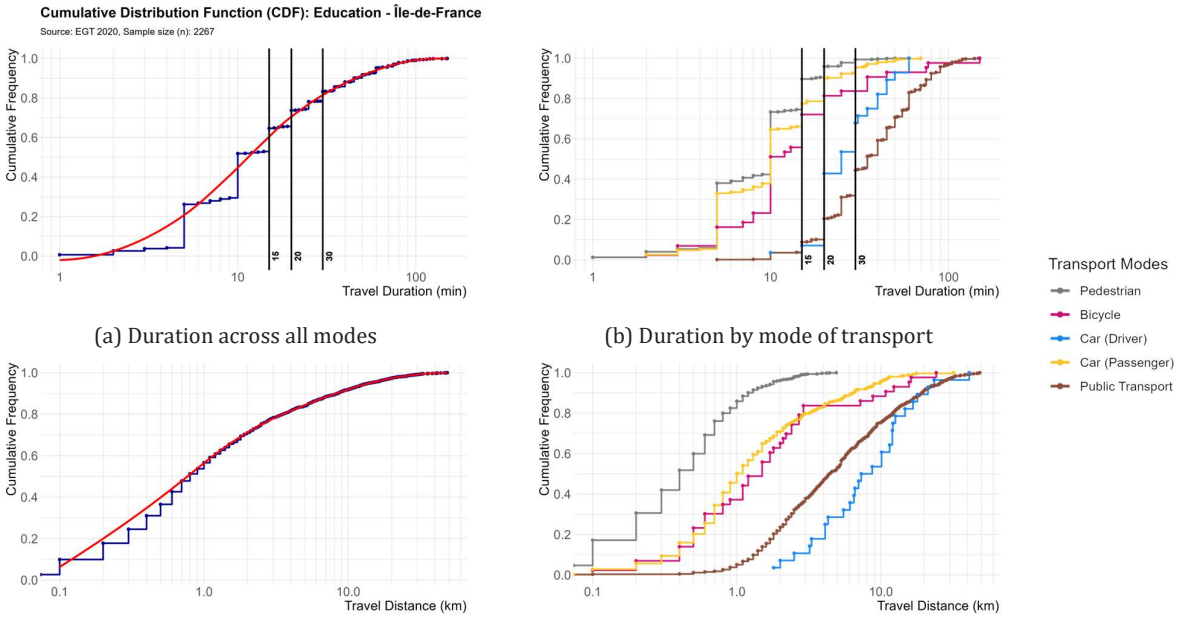
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 78: Density plot of educational trip duration (a) and distance (b) by transport mode – Île-de-France

Table 75: Educational trip statistics by transport mode – Île-de-France

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	2267	19.65	10.0	20.47	2.95	0.8	5.62
Pedestrians	1234	10.02	10.0	6.35	0.60	0.4	0.61
Bicycle	43	19.95	10.0	25.93	3.28	1.5	5.15
Car (as Driver)	28	29.50	25.0	13.01	10.30	8.0	8.33
Car (as Passenger)	351	12.44	10.0	9.70	2.37	1.0	3.44
Public Transport	611	42.77	35.0	24.69	7.68	4.4	8.28



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

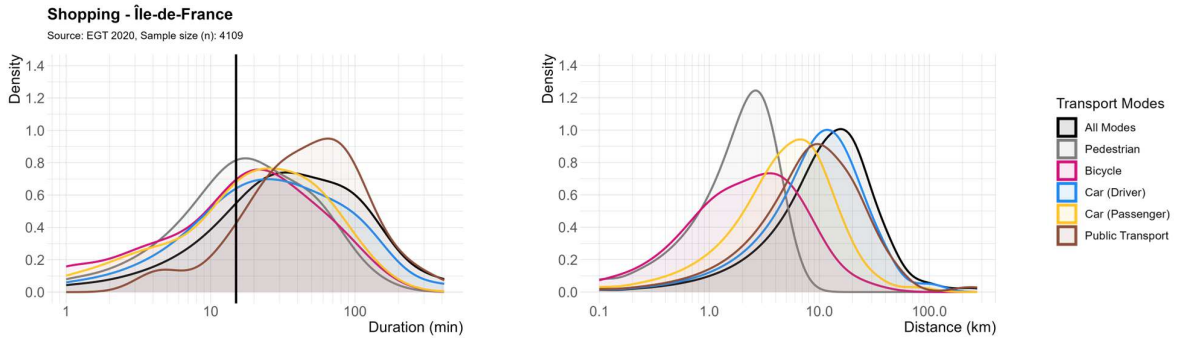
Figure 79: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Île-de-France

Table 76: Percentage of educational trips conducted for different time stamps – Île-de-France

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	73.3%	89.7%	95.9%	99.4%
Pedestrians	51.2%	72.1%	81.4%	
Bicycle	3.6%	7.1%	42.9%	67.9%
Car (as Driver)	51.9%	64.7%	73.7%	83.3%
Car (as Passenger)	64.7%	77.5%	90.0%	95.4%
Public Transport	3.6%	8.8%	20.5%	44.5%

8.4.3. Shopping trips

On average, shopping trips in Île-de-France region last approximately 16 minutes, with a distance covered of 3 kilometres. The predominant mode of transportation is walking, followed by car and public transport. On average, individuals in the Île-de-France region walk for 10 minutes to access shopping facilities, with almost 90% of these trips lasting up to 15 minutes. Car journeys, on the other hand, are comparatively lengthy, although they do cover greater distances. The high proportion of trips completed within 15 minutes underscores a high degree of proximity to shopping amenities in the Île-de-France region.



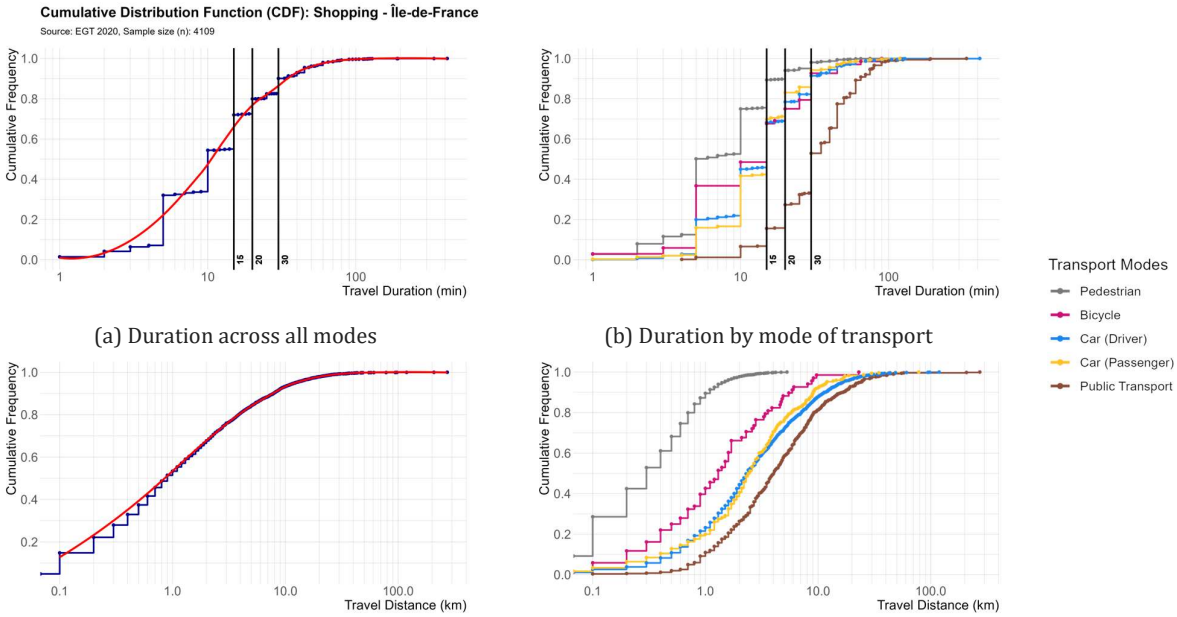
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 80: Density plot of shopping trip duration (a) and distance (b) by transport mode – Île-de-France

Table 77: Shopping trip statistics by transport mode – Île-de-France

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	4109	16.21	10.0	17.82	3.05	0.9	8.01
Pedestrians	1954	9.73	5.0	8.50	0.49	0.3	0.56
Bicycle	68	16.47	15.0	15.50	2.42	1.3	3.42
Car (as Driver)	1291	17.45	15.0	18.31	4.89	2.4	7.84
Car (as Passenger)	295	16.57	15.0	13.09	4.23	2.5	6.40
Public Transport	501	38.05	30.0	26.13	7.68	4.1	16.86



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

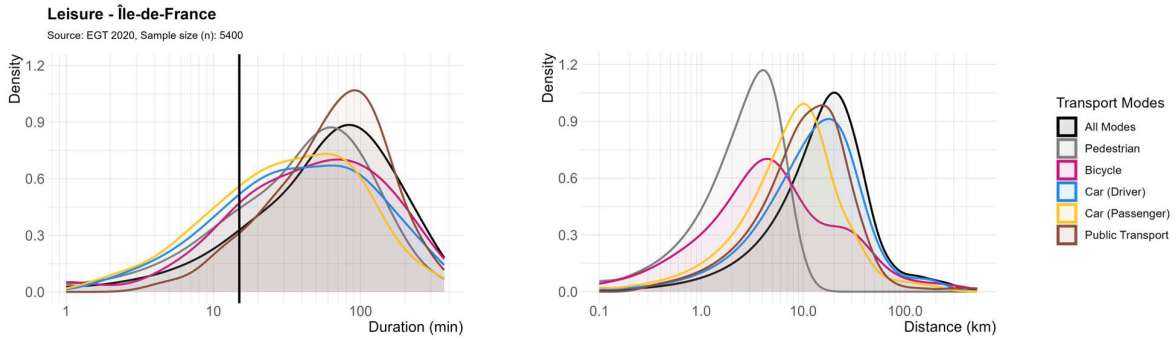
Figure 81: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Île-de-France

Table 78: Percentage of shopping trips conducted for different time stamps – Île-de-France

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	54.4%	72.0%	79.9%	90.1%
Pedestrians	75.0%	89.4%	94.1%	98.1%
Bicycle	48.5%	67.6%	75.0%	92.6%
Car (as Driver)	45.0%	68.2%	78.5%	91.4%
Car (as Passenger)	41.7%	69.8%	83.1%	94.2%
Public Transport	6.6%	15.6%	27.3%	52.9%

8.4.4. Leisure trips

The average travel time for residents of Île-de-France to reach a leisure facility is 23 minutes, with a distance of 4 kilometres being covered. According to Table 80, almost 60% of these journeys are completed within 15 minutes. Walking is the most used mode for leisure trips, followed by car (as driver) and public transport. On average, walking trips are brief in both distance and duration, with 75% of them lasting up to 15 minutes. The car is also a popular transport mode in this trip category for longer distances. Bicycle trips are characterised by their extended duration, with an average duration of 34 minutes. The high standard deviation in the sample indicates that the bicycle is used for both short and long leisure trips by Île-de-France residents, with 75% of trips completed within 15 minutes. Finally, trips made by public transport are on average the longest (46 minutes) and cover longer distances than those made by other travel modes. Therefore, a relatively limited proportion (10.3%) of these trips last up to 15 minutes.



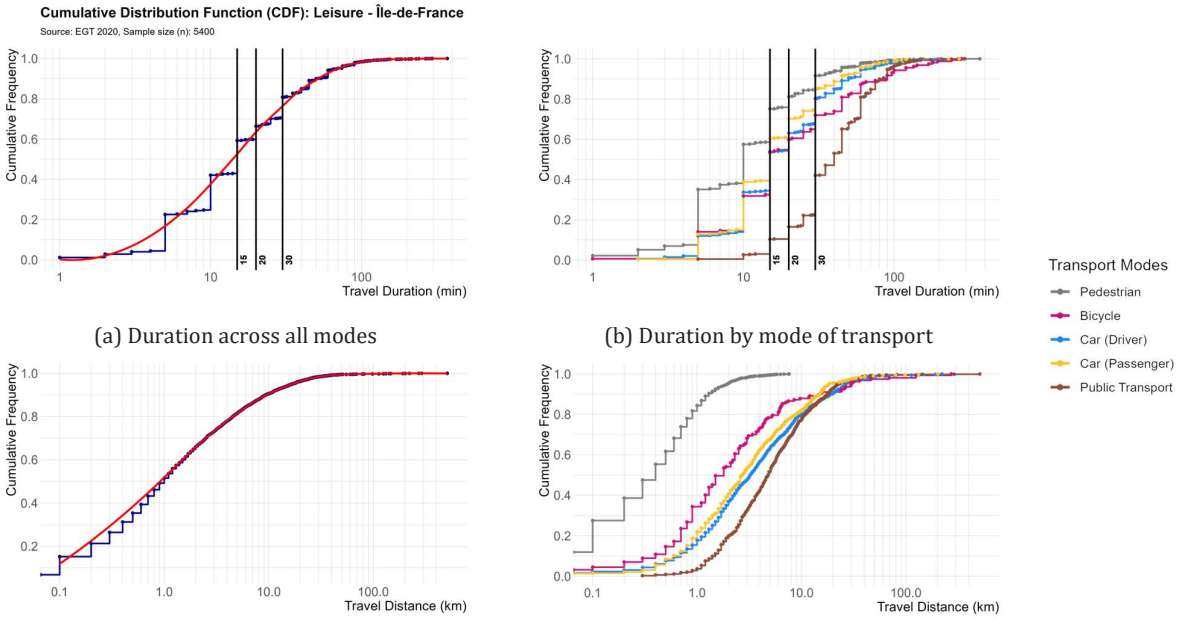
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 82: Density plot of leisure trip duration (a) and distance (b) by transport mode – Île-de-France

Table 79: Leisure trip statistics by transport mode – Île-de-France

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	5400	23.10	15.0	25.95	4.02	1.0	13.34
Pedestrians	2830	15.53	10.0	18.58	0.60	0.4	0.76
Bicycle	157	33.99	15.0	43.50	8.03	1.8	26.80
Car (as Driver)	1086	24.98	15.0	26.71	7.80	3.3	15.97
Car (as Passenger)	533	21.91	15.0	23.18	6.39	2.7	13.46
Public Transport	794	46.17	40.0	29.64	8.63	4.8	22.54



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 83: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Île-de-France

Table 80: Percentage of leisure trips conducted for different time stamps – Île-de-France

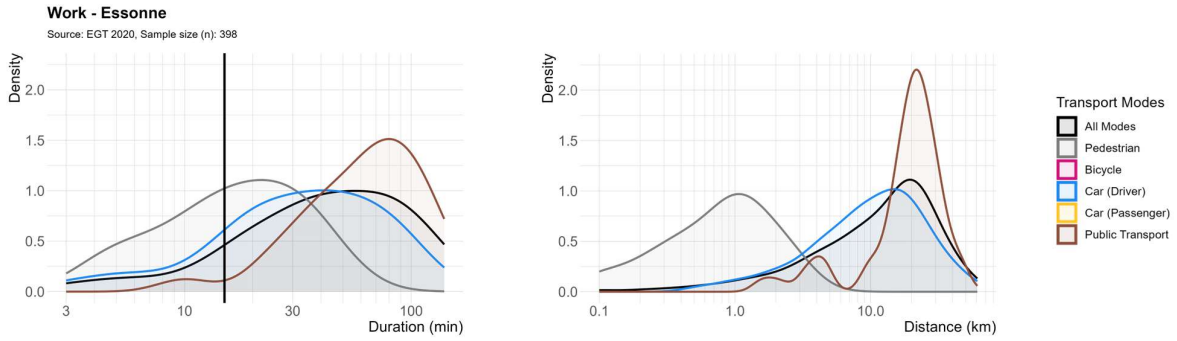
Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	42.1%	59.2%	66.4%	80.8%
Pedestrians	57.5%	75.1%	81.2%	91.6%
Bicycle	31.8%	53.5%	59.9%	72.0%
Car (as Driver)	33.7%	53.9%	63.1%	80.2%
Car (as Passenger)	38.8%	60.4%	70.2%	85.0%
Public Transport	2.6%	10.3%	16.5%	42.1%

8.5.Trip Characteristics – Essonne

The survey used for this analysis includes a limited number of trips made by Essonne's residents. For greater accuracy and to avoid misleading results, we analyse the trip characteristics of travel modes with more than 20 entries in the sample. However, the sample size of the general statistics presented in the following tables, includes all the travel modes represented in the sample, irrespective of their number of entries only.

8.5.1.Work trips

The average duration of commutes to work in the Essonne region is approximately 40 minutes. The proportion of journeys completed within 15 minutes is almost 30%, which is considerably lower than the proportion calculated for commuting trips in the wider region (88.5%). This finding suggests that residents of Essonne allocate a significant amount of time to their daily commutes. The most common modes of commuting are cars, public transport, and walking; however, the limited sample size precludes the ability to derive meaningful insights into the utilisation of alternative modes. Trips made by public transport last on average 70 minutes and according to Table 48, only 1.0% of them last up to 15 minutes. This may be attributable to the fact that a significant proportion of Essonne residents are employed in Paris region, which results in extended travel times. Car trips are also extended both in duration and distance, however, they cover shorter distances compared to trips made by public transport. The results obtained demonstrate that Essonne residents face extended travel times to reach their place of employment, a circumstance that engenders a high degree of reliance on motorised transport and consequently longer commutes.



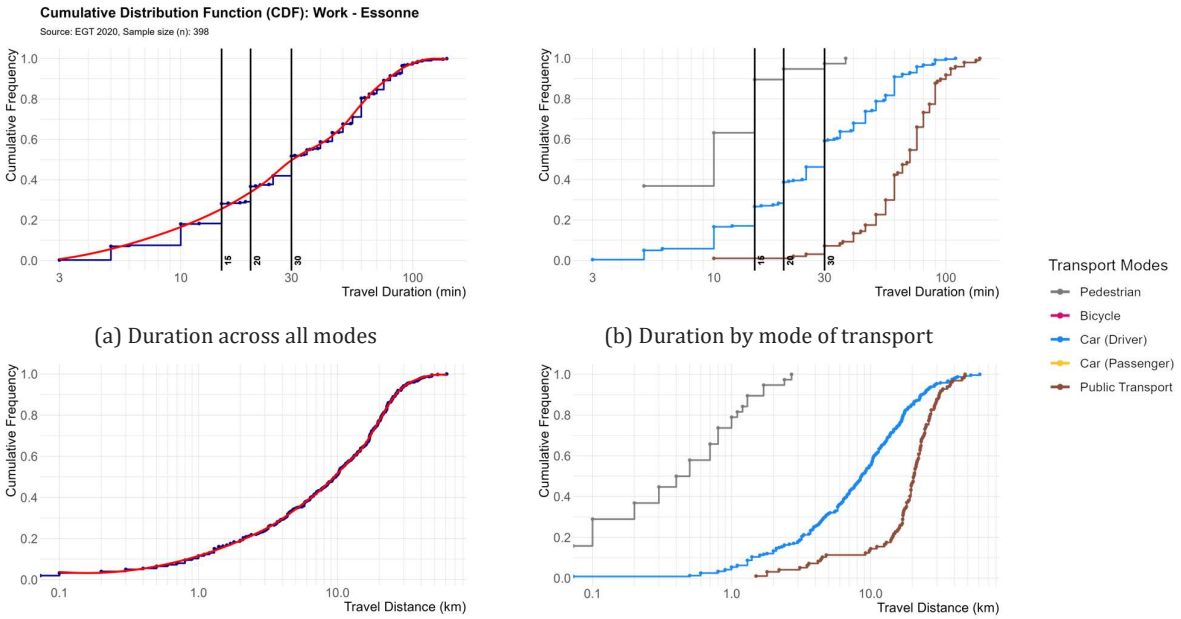
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 84: Density plot of work trip duration (a) and distance (b) by transport mode – Essonne

Table 81: Work trip statistics by transport mode – Essonne

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	398	39.56	30.0	27.99	12.25	9.8	10.86
Pedestrians	38	11.24	10.0	7.11	0.64	0.5	0.67
Bicycle	Insufficient sample size for analysis						
Car (as Driver)	240	33.78	30.0	22.11	11.26	8.7	9.97
Car (as Passenger)	Insufficient sample size for analysis						
Public Transport	97	69.1	70.0	24.14	20.61	20.6	9.65



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

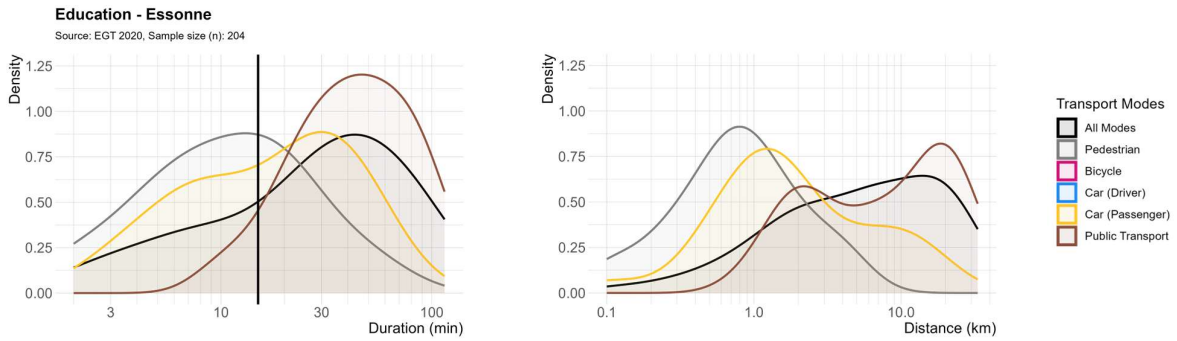
Figure 85: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Essonne

Table 82: Percentage of work trips conducted for different time stamps – Essonne

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	18.1%	28.1%	36.7%	51.8%
Pedestrians	63.2%	89.5%	94.7%	97.4%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)	16.7%	26.7%	38.8%	59.2%
Car (as Passenger)	Insufficient sample size for analysis			
Public Transport	1.0%	1.0%	1.0%	7.2%

8.5.2. Educational trips

The average travel time for residents of the Essonne region to reach an educational institution is 25 minutes, as indicated in Table 84. Notably, almost 53% of these trips last up to 15 minutes, suggesting a high degree of proximity to educational institutions in the Essonne region. The predominant modes of transportation for this purpose are walking and public transport. As expected, walking trips are characterised by their brevity, with 89% of them being completed within 15 minutes. In contrast, trips undertaken by public transport are of a more extended nature, a phenomenon that can be attributed to the high proportion of individuals in Essonne who utilise public transport to access educational institutions that are located at a significant distance from their place of residence. However, the analysis is constrained by the limited number of trips undertaken by other travel modes, which limits the results.



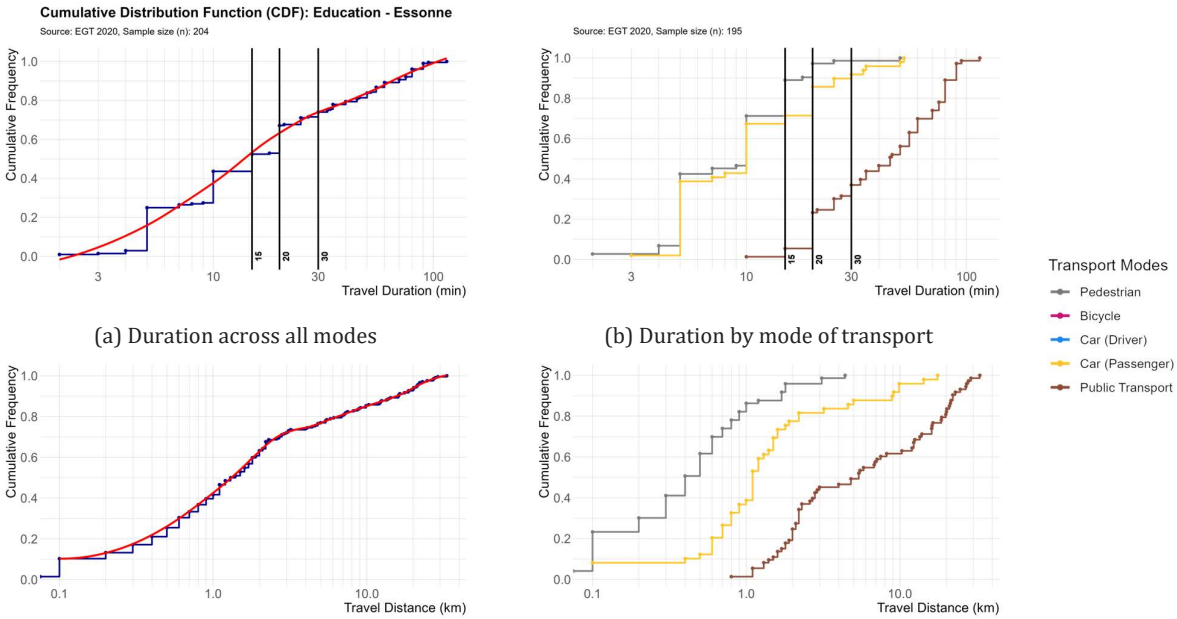
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 86: Density plot of educational trip duration (a) and distance (b) by transport mode – Essonne

Table 83: Educational trip statistics by transport mode – Essonne

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	204	25.15	15.0	24.93	4.39	1.4	6.89
Pedestrians	73	10.09	10.0	7.09	0.65	0.4	0.77
Bicycle	Insufficient sample size for analysis						
Car (as Driver)							
Car (as Passenger)	49	13.24	10.0	11.32	2.52	1.1	3.74
Public Transport	73	48.83	45.0	26.52	9.39	5.4	9.00



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

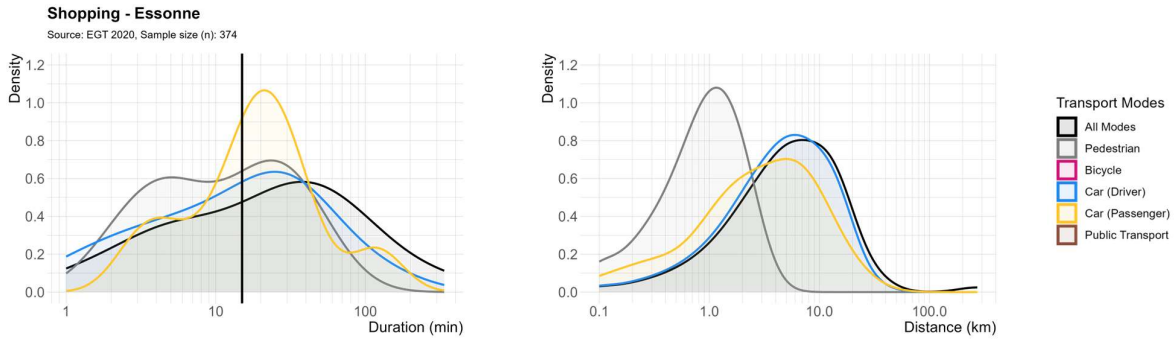
Figure 87: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Essonne

Table 84: Percentage of educational trips conducted for different time stamps – Essonne

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	43.6%	52.5%	67.2%	74.0%
Pedestrians	71.2%	89.0%	97.3%	98.6%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)				
Car (as Passenger)	67.3%	71.4%	85.7%	91.8%
Public Transport	1.4%	5.5%	23.3%	37.0%

8.5.3. Shopping trips

The average duration of shopping trips in the Essonne region is approximately 17 minutes, with a distance covered of almost 4 kilometres. The predominant mode of transport for shopping-related trips is the car, followed by walking. In comparison, trips made on foot are brief, with a significant proportion (83%) being completed within a time frame of 15 minutes. Conversely, shopping trips undertaken by car are characterised by a longer duration and greater distance travelled. The analysis indicates that a significant proportion of shopping trips in Essonne region are completed within 15 minutes (69.3%), suggesting a high degree of proximity to shopping facilities. However, it should be noted that the findings are based on a limited sample size, which may limit the generalizability of the results.



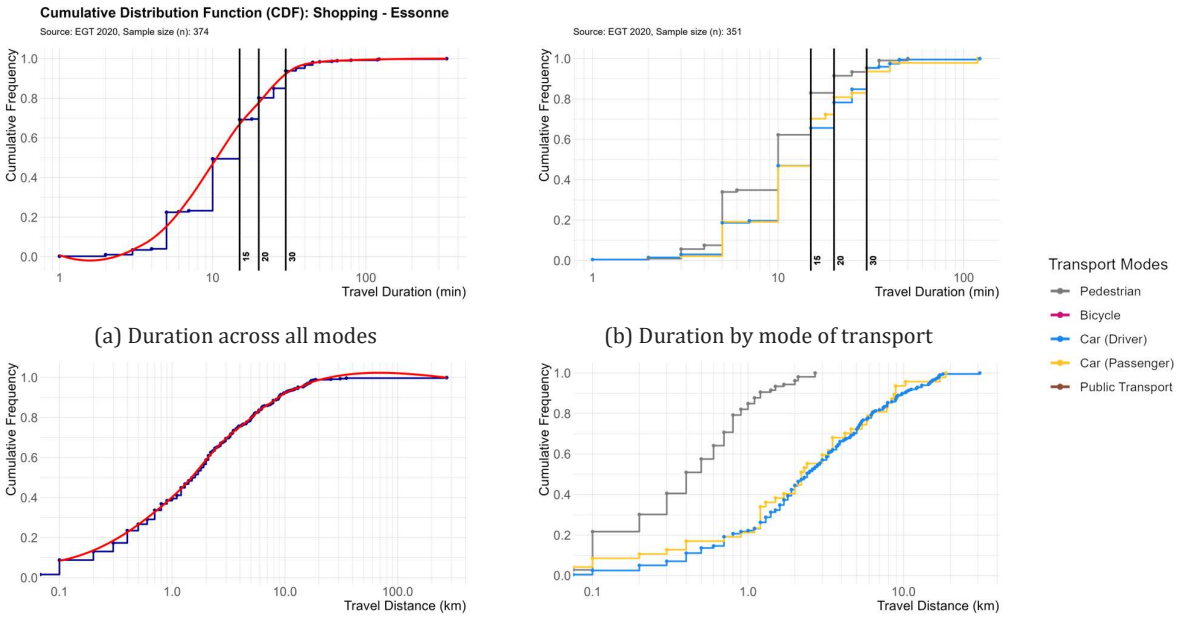
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 88: Density plot of shopping trip duration (a) and distance (b) by transport mode – Essonne

Table 85: Shopping trip statistics by transport mode – Essonne

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	374	16.65	15.0	21.17	3.95	1.6	14.64
Pedestrians	106	11.99	10.0	8.44	0.60	0.4	0.56
Bicycle	Insufficient sample size for analysis						
Car (as Driver)	198	16.11	15.0	12.19	4.14	2.4	4.55
Car (as Passenger)	47	17.24	15.0	17.71	3.80	2.2	4.14
Public Transport	Insufficient sample size for analysis						



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

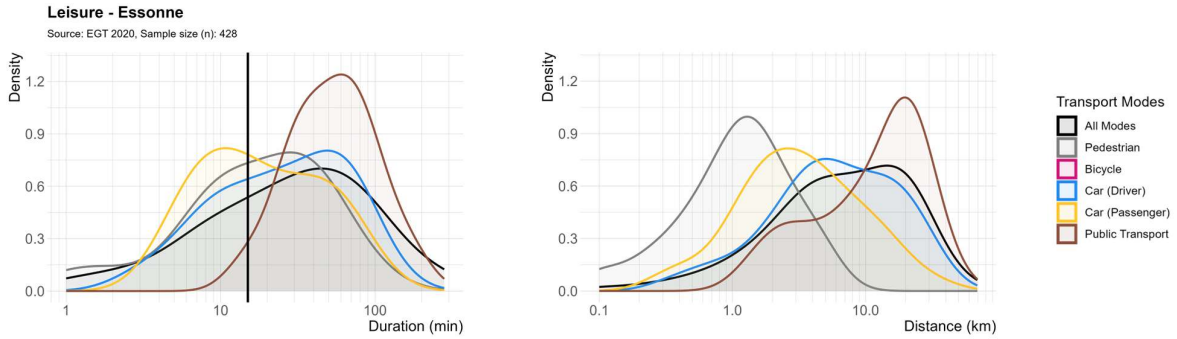
Figure 89: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Essonne

Table 86: Percentage of shopping trips conducted for different time stamps – Essonne

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	49.5%	69.3%	80.2%	93.9%
Pedestrians	62.3%	83.0%	91.5%	95.3%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)	47.0%	65.7%	78.3%	95.5%
Car (as Passenger)	46.8%	70.2%	80.9%	93.6%
Public Transport	Insufficient sample size for analysis			

8.5.4. Leisure trips

The average duration of leisure trips in Essonne is 23 minutes, while Table 88 shows that 58.2% of these trips last less than 15 minutes. The most frequently used means of transport for these trips are walking and the car. Leisure trips made on foot take an average of 18 minutes, while almost 65% of them are completed within 15 minutes. On the other hand, car trips to leisure facilities are longer. Leisure trips by public transport are the longest in terms of both duration and distance, suggesting that people use public transport to reach leisure facilities that are significantly far from where they live.



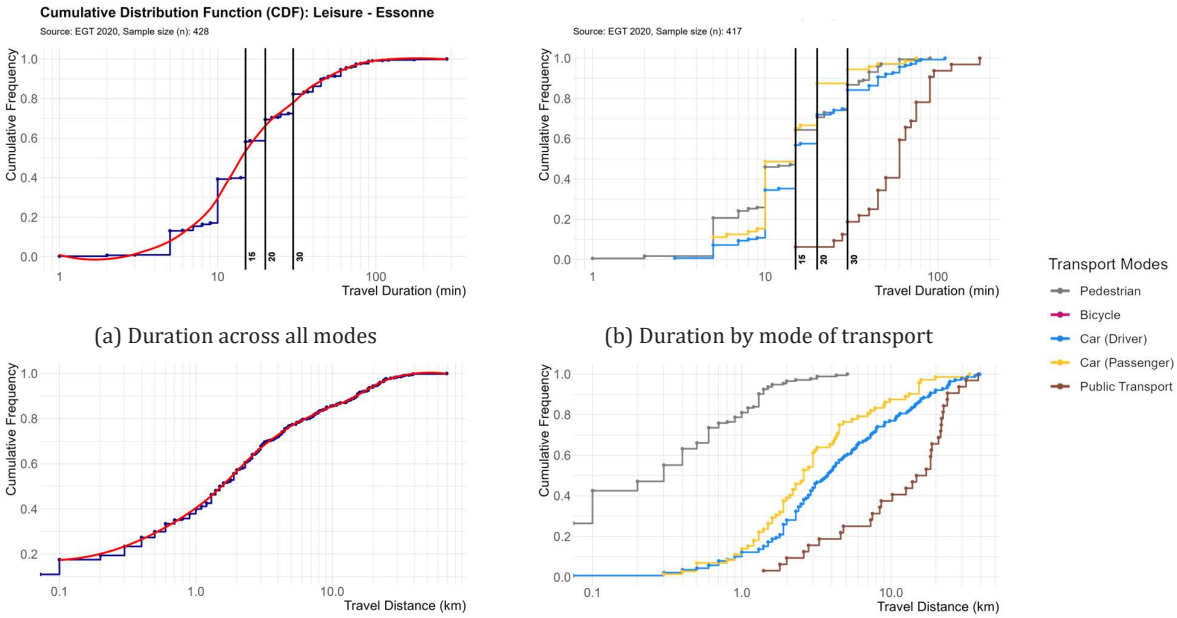
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 90: Density plot of leisure trip duration (a) and distance (b) by transport mode – Essonne

Table 87: Leisure trip statistics by transport mode – Essonne

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	428	22.82	15.0	24.06	4.61	1.6	7.69
Pedestrians	174	18.12	15.0	14.33	0.54	0.3	0.77
Bicycle	Insufficient sample size for analysis						
Car (as Driver)	139	21.91	15.0	18.02	7.06	3.8	7.92
Car (as Passenger)	72	16.31	15.0	12.20	4.73	2.6	5.68
Public Transport	32	62.13	60.0	32.29	14.84	16.0	9.69



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 91: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Essonne

Table 88: Percentage of leisure trips conducted for different time stamps – Essonne

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	39.3%	58.2%	69.4%	82.2%
Pedestrians	46.0%	64.4%	70.7%	86.8%
Bicycle	Insufficient sample size for analysis			
Car (as Driver)	34.5%	56.8%	71.9%	84.2%
Car (as Passenger)	48.6%	65.3%	87.5%	94.4%
Public Transport	6.3%	6.3%	6.3%	18.8%

8.6.Travel behaviour across different socioeconomic groups

The present section of the analysis is concerned with an examination of modal split and trip characteristics of different socioeconomic groups in Île-de-France. The main findings of the analysis are presented here, but the detailed results of the analysis can be found in **Appendix E** and **G**.

8.6.1.Gender

- Males travel significantly longer than women, for work and leisure trip purposes.
- Females tend to walk more often for shopping trips than males, who are more likely to use their cars for this purpose.
- Walking is the predominant mode of transportation for educational excursions, irrespective of gender.
- Females utilize public transport for commutes than males, who generally prefer private transportation.

8.6.2.Income

The dataset categorizes the economic situation of households in Île-de-France based on the monthly net income class of the household. For the purpose of the analysis, we have been merged the first six groups (less than 800€ – up to 3000€) into a single category called low income, and the last five groups (more than 3000€ - more than 5500€) into a single category called high income. This categorisation is based on the national statistics that state that for the year of 2021 the average net monthly income in Île-de-France was approximately 3,128€ (https://www.statista.com/statistics/1440766/average-net-monthly-income-in-france-by-gender-and-by-region/).

- Work and education trips have no significant variation both in duration and distance across income groups.
- Shopping trips are significantly longer in terms of distance for the low-income group.
- The trip duration of leisure trips is significantly longer for individuals from the low-income group.

8.6.3.Age

In order to analyse travel behaviour across age in Île-de-France, the sample has been divided into four groups. The groups are the following:

1. Children/Students (up to 18 years old)
2. Young adults (19 to 39 years old)
3. Middle-aged adults (40 to 59 years old)
4. Old adults (over 60 years old)

- Work travel distance differs significantly across age groups, but duration does not.
- Education trips show the largest variation, with young adults traveling significantly farther and longer.
- Shopping and leisure trips increase slightly with age but remain relatively short.

- Older adults take the longest leisure trips, while younger adults have the longest education trips.
- Car usage increases with age, especially for shopping and leisure trips.
- Public transport is the predominant mode for work and education trips for young adults.
- Middle-aged and older adults rely more on cars for non-work trips.

9. MUNICH

9.1.General characteristics of Munich and LL location

The capital of the southern German state of Bavaria is the city Munich, which has a population of 1,48 million inhabitants and is the third largest city in Germany. Munich's public transport network consists of suburban railways, eight metro lines, tram lines, bus lines and an extensive cycling infrastructure. Furthermore, the city offers a plethora of active and shared mobility options.

The Munich Living Lab constitutes the two municipalities of Geretsried and Wolfratshausen, which are located in the southern part of Munich. Geretsried has an approximate population of 25,705, while Wolfratshausen has a total population of 19,115 inhabitants. Both municipalities are walkable and cyclable, and they are connected with the city of Munich via suburban railways and buses.

Figure 92 shows the map of Munich and the location of the Munich Living Lab (red pins).

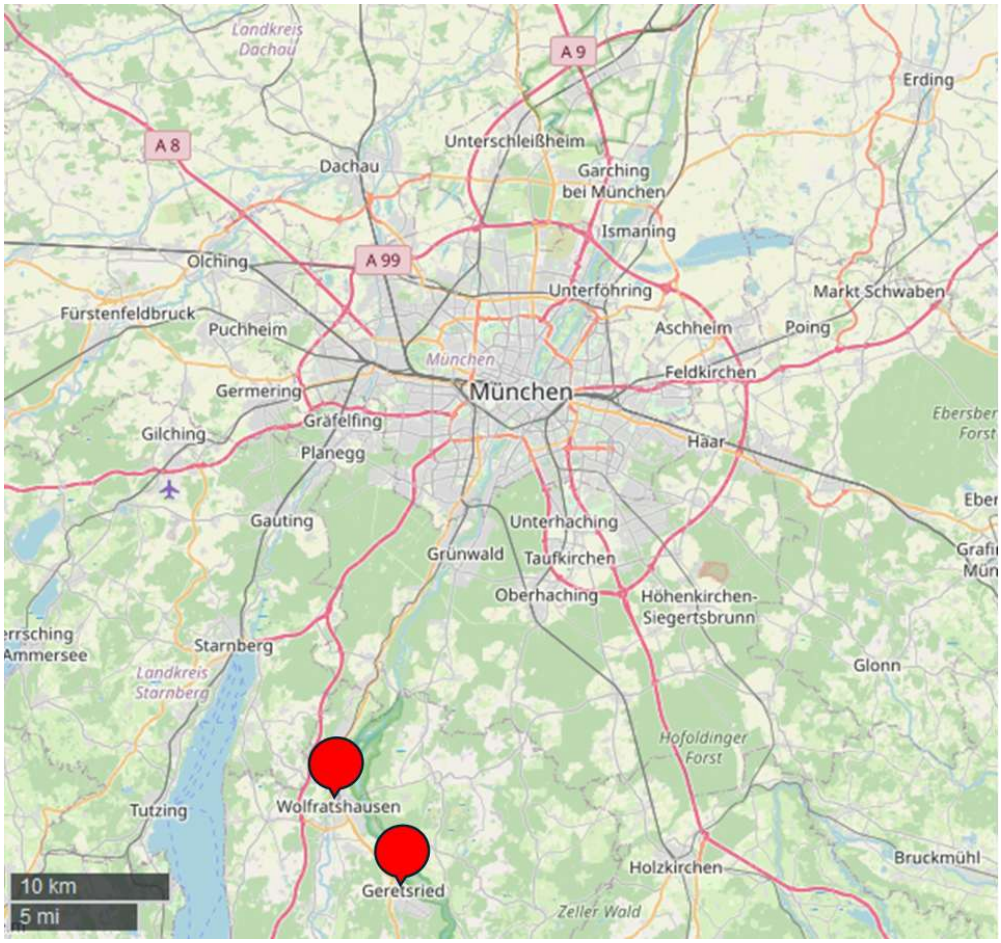


Figure 92: Location of the Munich Living Labs (red pins) (Source: OSM (2024))

9.2.Descriptive statistical analysis

For the descriptive statistical analysis for the Munich region and the Munich Living Lab region, the dataset "Mobilität in Deutschland (MiD) 2017" (12) was used. A list of socioeconomic variables, both for households and individuals, was selected and presented in Tables Table 89 and Table 90 respectively.

It is important to acknowledge the limitations imposed by the relatively modest sample size of trips made by residents of the of Geretsried and Wolfratshausen municipalities. This limits the scope and generalisability of the results of the analysis. In order to address these limitations, a comprehensive analysis of all the dense towns at S-Bahn termini is conducted, since all these towns share common socio-economic and travel characteristics.

The sample used for this part of the analysis is the *total resident population* within the area (Munich or Munich LL), with no filtering for specific trip purposes. Furthermore, the sample of survey respondents who did not provide a valid response to one or more of the selected questions was excluded from the sample

Table 89: Socioeconomic characteristics of households (Munich & Dense Towns at S-Bahn Termini) – Source: MiD 2017

Socioeconomic Characteristics of Households				
	Munich		LL Location (Dense Towns at S-Bahn Ter.)	
	n	%	n	%
Household size				
1 Person	2582	31.4	101	17.2
2 Persons	3547	43.2	262	44.6
3 Persons	1051	12.8	88	15
4+ Persons	1038	12.6	137	23.3
Economic situation				
Very poor	220	2.7	21	3.6
Poor	497	6	35	6
Average	3255	39.6	225	38.3
Good	2970	36.1	239	40.6
Very good	1276	15.5	68	11.6
Car ownership				
0	2013	24.5	24	4.1
1	4598	56	293	49.8
2+	1607	19.6	271	46.1

Table 90: Socioeconomic characteristics of individuals (Munich & Dense Towns at S-Bahn Termini) – Source: MiD 2017

Socioeconomic Characteristics of Individuals				
	Munich		LL Location (Dense Towns at S-Bahn Ter.)	
	n	%	n	%
Gender				
Male	7755	49.1	666	49.2
Female	8026	50.9	687	50.8
Age Category (y.o.)				
0 - 17	2088	13.2	223	16.5
18 - 29	1777	11.3	153	11.4
30 - 39	2352	14.9	123	9.1
40 - 49	2152	13.6	194	14.4
50 - 59	2419	15.3	236	17.5
60 - 69	2040	12.9	221	16.4
70 - 79	2140	13.6	155	11.5
80+	804	5.1	43	3.2
Occupation				
Student	2203	14	261	19.3
Employed	7865	49.9	630	46.7
Pensioner	3974	25.2	327	24.2
Other	1735	11	132	9.8
Car driving license				
Yes	10831	91.7	886	94.2
No	982	8.3	55	5.8
Car availability				
Always	8672	74.9	792	85.7
Occasionally	1701	14.7	81	8.8
Never	1210	10.4	51	5.5
Bicycle availability				
Yes	12865	81.6	1125	83.2
No	2897	18.4	227	16.8

The descriptive statistical analysis provides a comprehensive overview of the demographic profiles of residents in Munich and the Munich Living Lab region. With respect to gender, the population in the sample is almost equally distributed. However, a marked disparity emerges with respect to vehicle ownership, with the Munich Living Lab region exhibiting a significantly higher rate compared to the Munich sample. While the majority of households in Munich LL possess at least one car, in Munich, the proportion of households without cars is higher. With respect to occupation, both samples are predominantly comprised of employed individuals and pensioners. With respect to income, the majority of households in both regions report an average or good economic situation.

9.3.Modal split

Figure 93 shows the modal split by trip purpose for the city of Munich. For working commutes, public transport is the most preferred mode for Munich residents, followed by driving and cycling. For educational trips, public transport is once again the most prevalent mode of transport, though the share of cycling and walking trips is also high. In contrast, shopping trips are predominantly undertaken on foot, while car usage remains notably high. With respect to leisure trips, here walking emerges as the predominant mode with 43%, followed by public transport and car usage. The modal split in Munich demonstrates a clear preference for public transport for work and educational purposes, and for walking for shopping and leisure purposes. Nevertheless, car usage and bicycle usage persist as prevalent modes for work-related and shopping-related trips.

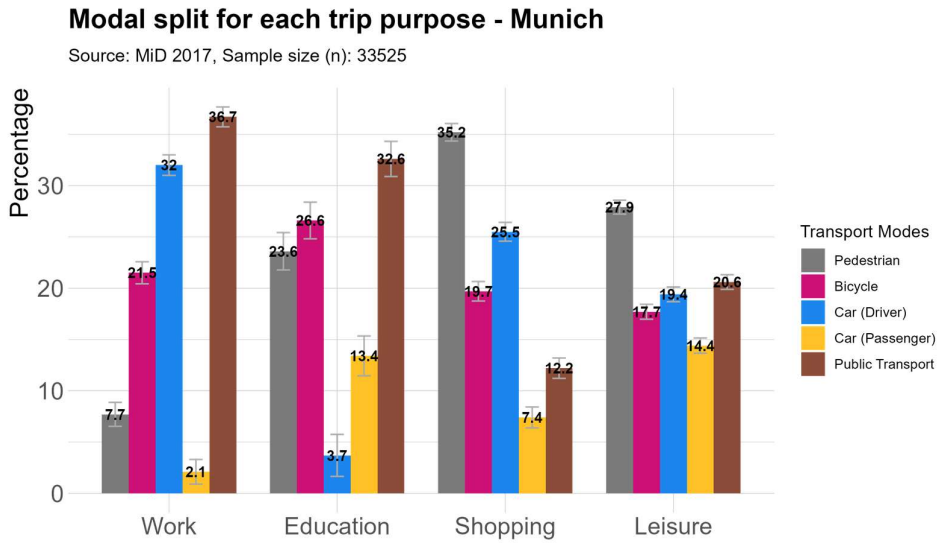


Figure 93: Modal split by trip purpose – Munich

The results of the modal split analysis in the Munich Living Lab area, as presented in Figure 94, indicate a clear preference for driving for work-related trips. In comparison with the results for the wider Munich area, where public transport is the predominant mode of transport, there is a marked increase in car usage for daily commutes, accompanied by a decline in cycling and public transport usage. A similar trend is observed in the context of shopping, with an increase in car use for this purpose. Furthermore, it is observed that leisure trips are predominantly undertaken by car or on foot. The modal split results in Munich Living Lab area indicate a reliance on motorized transport, particularly for work and shopping trips, contrasting with the results of the modal split in Munich.

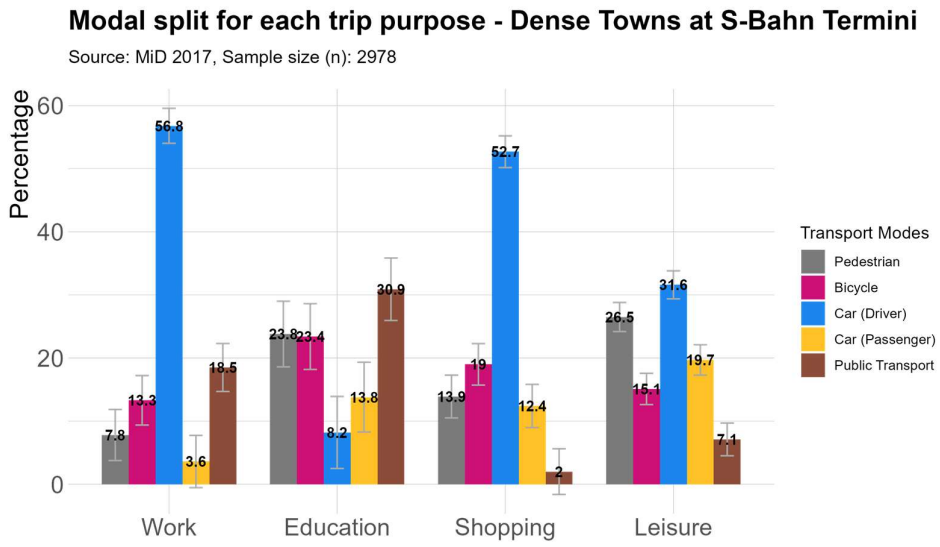
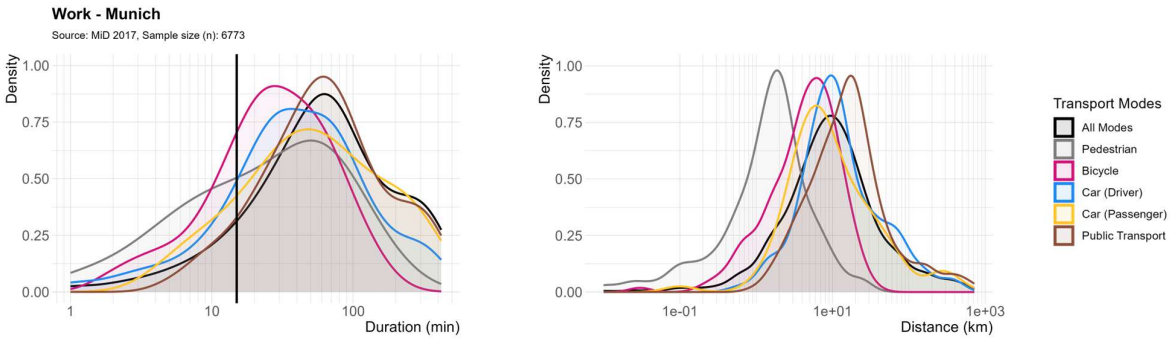


Figure 94: Modal split by trip purpose – Dense Towns at S-Bahn Termini

9.4.Trip Characteristics – Munich

9.4.1.Work trips

The mean travel time for commuters in Munich is 32 minutes, with a distance of 12 kilometres being covered. According to Table 92, 26% of the commutes in Munich are completed within 15 minutes. The most common modes of transportation for commuting are public transport, private vehicle and bicycle. The mean duration of public transport commutes is 42 minutes, while the mean distance travelled is 14.5 kilometres. In contrast, commutes by car are comparatively brief, yet cover extended distances. Bicycle commutes, on average, last approximately 23 minutes, and 44% of these are completed within 15 minutes. The analysis indicates that individuals in Munich allocate a substantial portion of their daily time to commuting and they are dependent on motorized transport and the public transportation system.



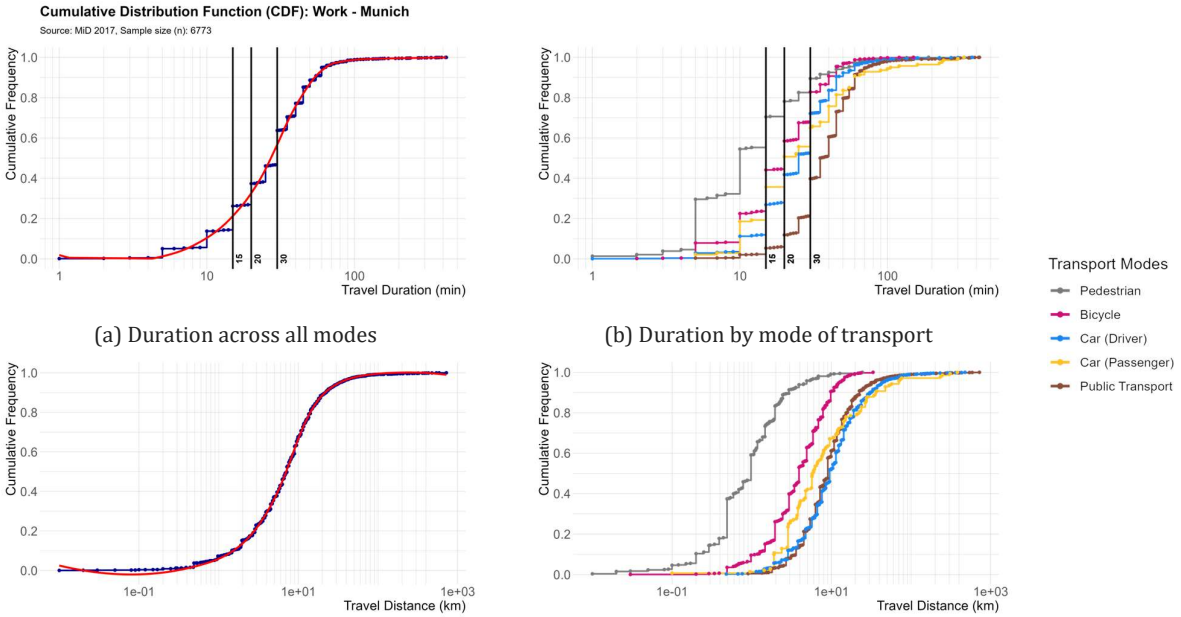
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 95: Density plot of work trip duration (a) and distance (b) by transport mode – Munich

Table 91: Work trip statistics by transport mode – Munich

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	6773	31.90	30.00	26.91	12.06	7.20	28.93
Pedestrians	521	16.89	10.00	18.02	1.50	0.98	2.35
Bicycle	1459	22.73	20.00	14.32	5.10	3.92	4.11
Car (as Driver)	2166	29.28	25.00	22.88	15.98	9.50	28.56
Car (as Passenger)	140	38.34	20.00	50.36	20.17	5.87	50.26
Public Transport	2487	42.34	35.00	31.19	14.49	9.00	36.64



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

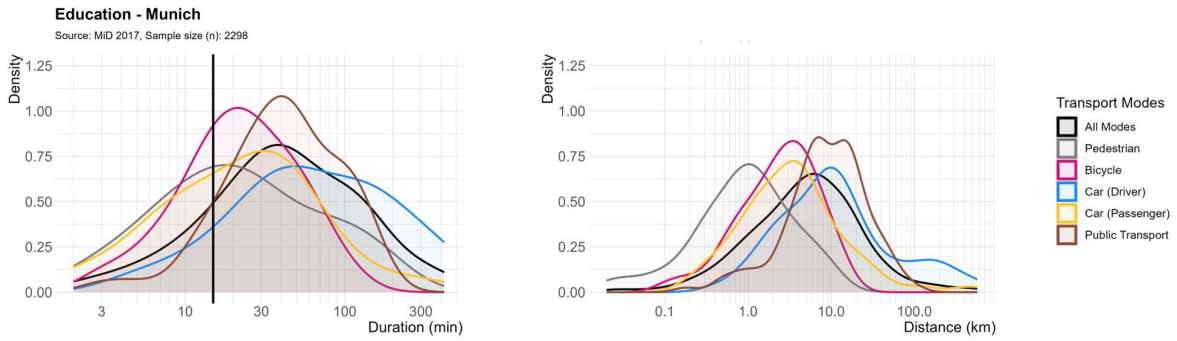
Figure 96: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Munich

Table 92: Percentage of work trips conducted for different time stamps – Munich

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	13.7%	26.2%	37.4%	63.7%
Pedestrians	54.5%	70.4%	78.1%	89.4%
Bicycle	22.5%	44.1%	58.5%	82.8%
Car (as Driver)	11.2%	26.9%	41.8%	72.1%
Car (as Passenger)	18.6%	35.7%	50.7%	65.0%
Public Transport	2.1%	5.3%	11.9%	39.8%

9.4.2. Educational trips

Trips to educational institutions in Munich last on average 23.5 minutes, while covering almost 6 kilometres. According to Table 94, almost 55% of educational trips in Munich are completed within 15 minutes. The predominant mode of transportation in this category is public transport, followed by bicycle and walking. Educational trips undertaken by public transport have an average duration of 37 minutes (see Table 93: Educational trip statistics by transport mode – Munich), while covering 9 kilometres. Bicycle and walking trips are also popular, although the cover much shorter distances. Walking emerges as one of the prevalent modes, accounting for 82.5% of all education-related trips completed within the stipulated time frame. The results indicate a high degree of proximity to educational institutions in Munich.



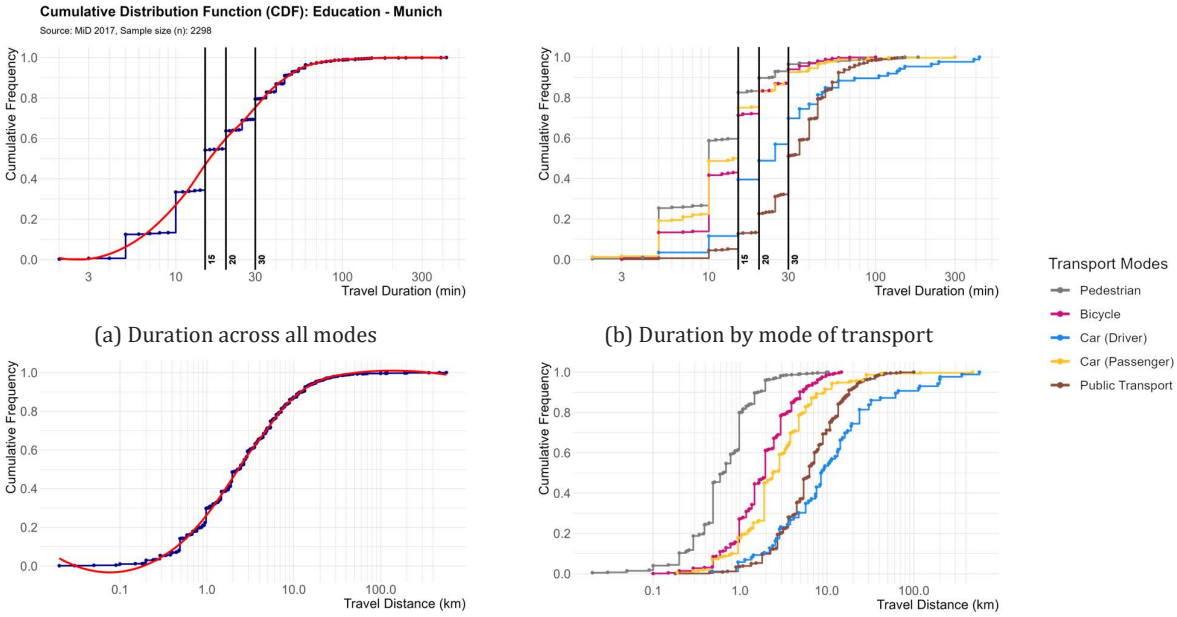
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 97: Density plot of educational trip duration (a) and distance (b) by transport mode – Munich

Table 93: Educational trip statistics by transport mode – Munich

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	2298	23.50	15.00	23.98	5.93	2.35	20.58
Pedestrians	543	14.10	10.00	15.80	0.88	0.64	0.95
Bicycle	612	16.04	15.00	10.41	2.51	1.96	2.29
Car (as Driver)	86	44.52	25.00	69.60	34.08	8.71	81.42
Car (as Passenger)	308	16.79	14.50	21.12	6.25	2.43	28.23
Public Transport	749	36.77	30.00	20.20	9.03	6.30	9.32



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

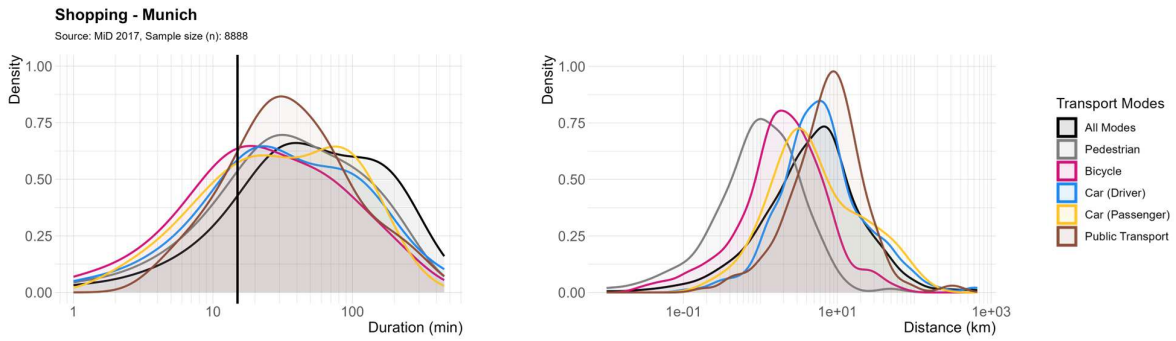
Figure 98: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Munich

Table 94: Percentage of educational trips conducted for different time stamps – Munich

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	33.4%	54.2%	63.7%	79.5%
Pedestrians	58.7%	82.5%	89.7%	96.5%
Bicycle	41.7%	71.2%	83.2%	94.0%
Car (as Driver)	11.6%	39.5%	48.8%	69.8%
Car (as Passenger)	48.7%	75.0%	83.1%	92.5%
Public Transport	4.5%	12.8%	22.7%	51.0%

9.4.3. Shopping trips

The mean duration of shopping trips in Munich is 17 minutes, with a total distance covered of almost 4 kilometres. The predominant mode of transportation is walking, followed by car and cycling. Furthermore, almost 72% of shopping trips in Munich are completed within 15 minutes. Walking and cycling trips are brief, both in distance and duration, while approximately 80% of them last up to 15 minutes. Car trips (as driver) tend to cover longer distances, although they are brief in duration. Finally, shopping trips undertaken by public transport cover similar distances to those made by car, yet they are characterised by a longer duration. The findings of this study demonstrate that individuals in Munich predominantly utilise sustainable transport modes for shopping trips; however, they are still dependent on motorised transport when they wish to cover longer distances.



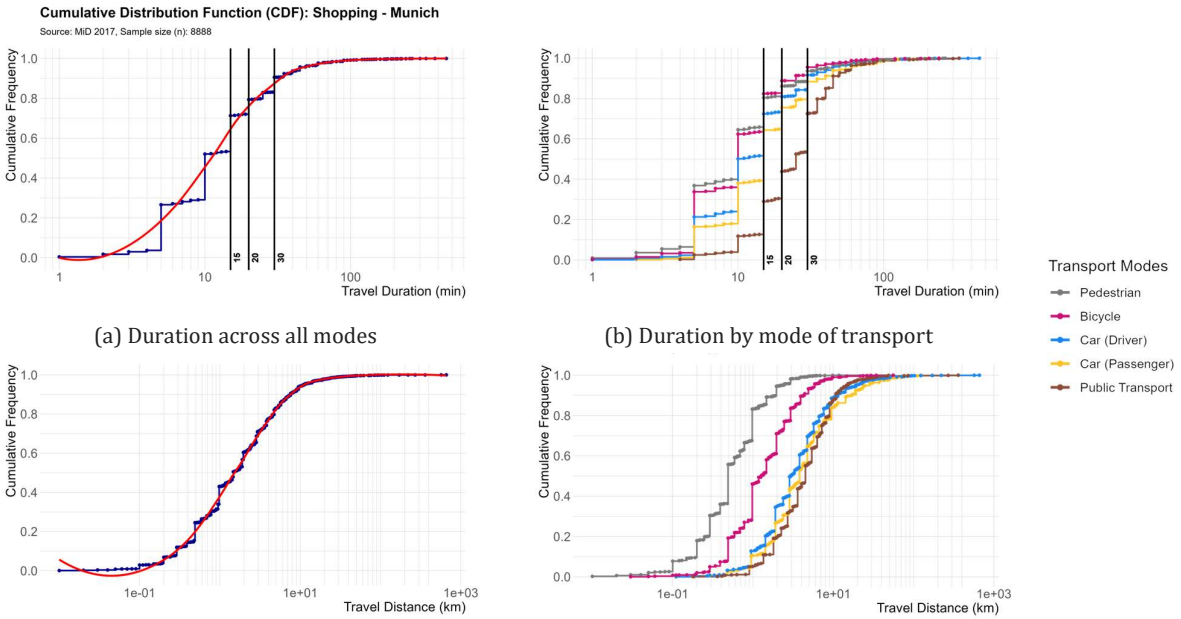
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 99: Density plot of shopping trip duration (a) and distance (b) by transport mode – Munich

Table 95: Shopping trip statistics by transport mode – Munich

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	8888	17.12	10.00	20.65	3.69	1.47	12.76
Pedestrians	3126	14.28	10.00	19.36	0.80	0.49	1.22
Bicycle	1752	13.34	10.00	15.28	2.08	1.27	2.83
Car (as Driver)	2264	17.22	10.00	21.17	6.44	2.95	21.18
Car (as Passenger)	662	20.25	15.00	21.04	7.59	3.80	12.93
Public Transport	1084	29.25	25.00	25.20	6.49	4.50	14.78



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

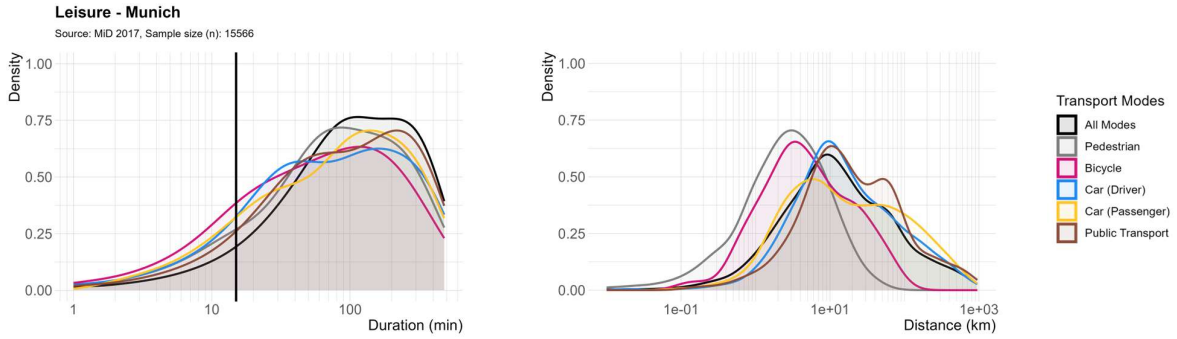
Figure 100: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Munich

Table 96: Percentage of shopping trips conducted for different time stamps – Munich

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	52.05	71.3%	79.4%	90.6%
Pedestrians	64.6%	80.4%	86.1%	93.7%
Bicycle	62.4%	82.4%	88.8%	95.5%
Car (as Driver)	50.1%	72.4%	80.9%	91.7%
Car (as Passenger)	38.1%	64.4%	75.5%	88.4%
Public Transport	11.8%	29.0%	43.8%	72.5%

9.4.4. Leisure trips

Leisure trips in Munich last on average 38 minutes, with a total distance covered of almost 16 kilometres. According to Table 98, 39.7% of the leisure trips in Munich are completed within 15 minutes. The most common modes of transportation for leisure are walking, public transport and car. The mean duration of walking trips is 35 minutes, while the mean distance travelled is 2 kilometres. Moreover, almost 50% of these walking trips last up to 15 minutes. However, these statistics may not necessarily indicate a lack of proximity to leisure facilities but rather suggest that residents of Munich place a high value on walking as a leisure activity in itself. In comparison, car journeys typically cover much longer distances, with only 38% of them lasting less than 15 minutes. Public transport trips, on average, are shorter in distance than car trips, although they tend to be longer in duration.



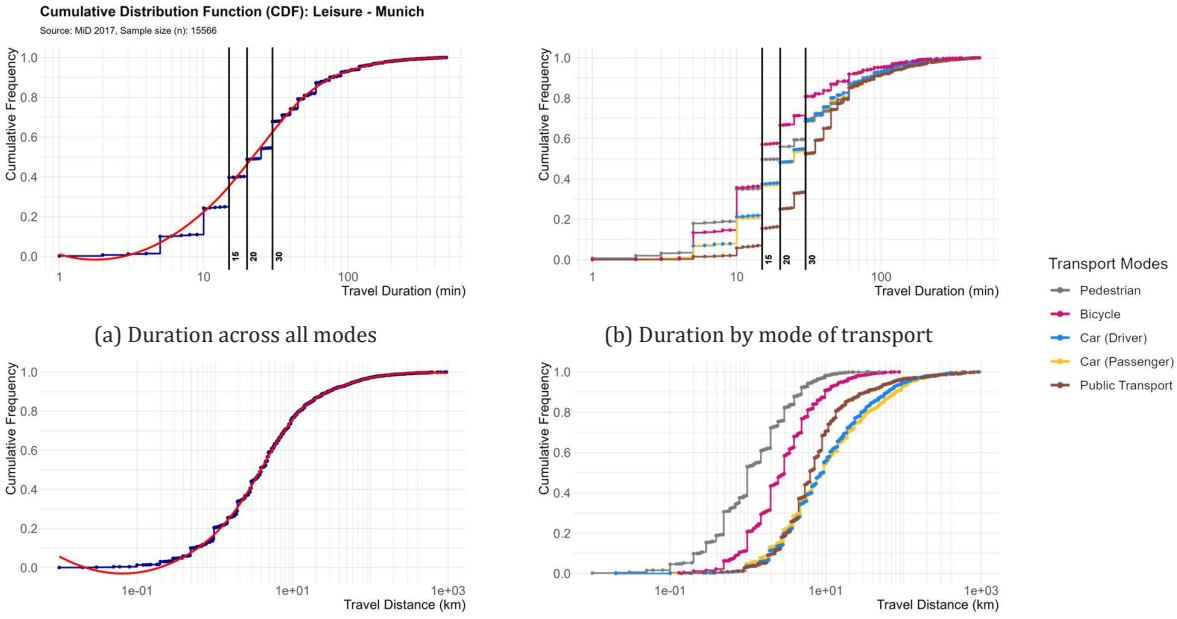
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 101: Density plot of leisure trip duration (a) and distance (b) by transport mode – Munich

Table 97: Leisure trip statistics by transport mode – Munich

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	15566	37.69	25.00	48.53	15.86	3.92	52.49
Pedestrians	4342	35.15	20.00	46.54	2.04	0.98	2.78
Bicycle	2759	27.84	15.00	38.33	4.82	2.94	7.20
Car (as Driver)	3013	38.04	25.00	49.48	27.14	9.12	62.22
Car (as Passenger)	2241	39.54	25.00	51.29	30.62	9.50	63.65
Public Transport	3211	47.96	30.00	53.82	23.15	6.30	78.46



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 102: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Munich

Table 98: Percentage of leisure trips conducted for different time stamps – Munich

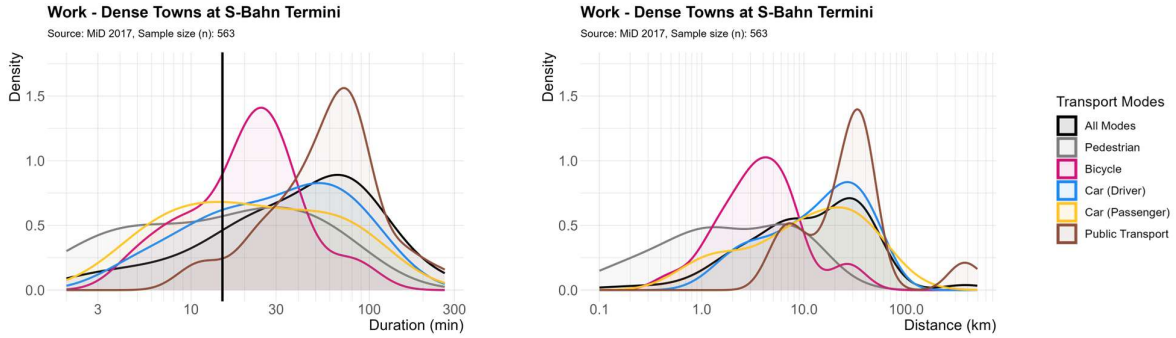
Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	24.3%	39.7%	48.9%	67.8%
Pedestrians	34.9%	49.6%	55.9%	69.9%
Bicycle	35.7%	57.1%	66.7%	80.9%
Car (as Driver)	21.2%	37.5%	48.3%	68.8%
Car (as Passenger)	20.5%	36.8%	48.1%	68.3%
Public Transport	5.8%	15.4%	25.1%	52.5%

9.5.Trip Characteristics – Dense Town at S-Bahn Termini

The survey used for this analysis includes a limited number of trips made by the residents of Munich's LL location. For greater accuracy and to avoid misleading results, we analyse the trip characteristics of travel modes with more than 20 entries in the sample. However, the sample size of the general statistics presented in the following tables, includes all the travel modes represented in the sample, irrespective of their number of entries only.

9.5.1.Work trips

The mean duration of the commutes made by residents of Munich's LL location is 31 minutes, with a total distance travelled of approximately 20 kilometres. It is observed that while the residents of Munich's LL location spend a similar amount of time commuting to work as the residents of the Munich region as a whole, they cover much longer distances on average. This finding suggests that the residents of Munich's LL location are employed in locations that are distant from their place of residence. However, as presented in Table 100, the proportion of trips completed within 15 minutes is almost 38%, while is higher than the proportion calculated for the commuting trips in the wider Munich region (26.2%). The analysis indicates that the predominant modes of commuting are driving and public transport. Trips made by public transport are characterised by an average duration of up to an hour and a distance covered of 40 kilometres. In comparison, car journeys are typically briefer in both distance and duration, with almost 34.5% of these journeys lasting no more than 15 minutes.



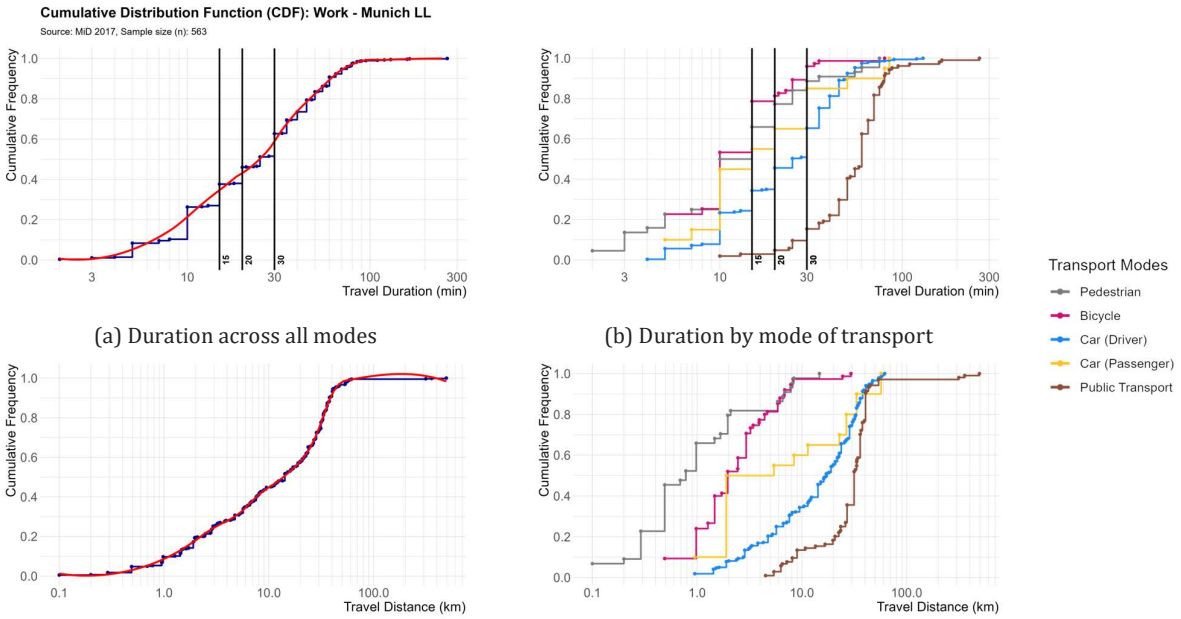
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 103: Density plot of work trip duration (a) and distance (b) by transport mode – Dense Towns at S-Bahn Termini

Table 99: Work trip statistics by transport mode – Dense Towns at S-Bahn Termini

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	563	30.88	25.00	25.05	19.67	19.67	19.67
Pedestrians	44	18.00	12.50	17.64	2.10	0.78	3.10
Bicycle	75	14.37	10.00	10.98	3.40	1.96	4.47
Car (as Driver)	320	27.69	25.00	17.85	19.56	17.10	14.49
Car (as Passenger)	20	24.10	15.00	23.01	14.94	3.65	18.41
Public Transport	104	59.35	60.00	31.54	40.07	31.50	62.98



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

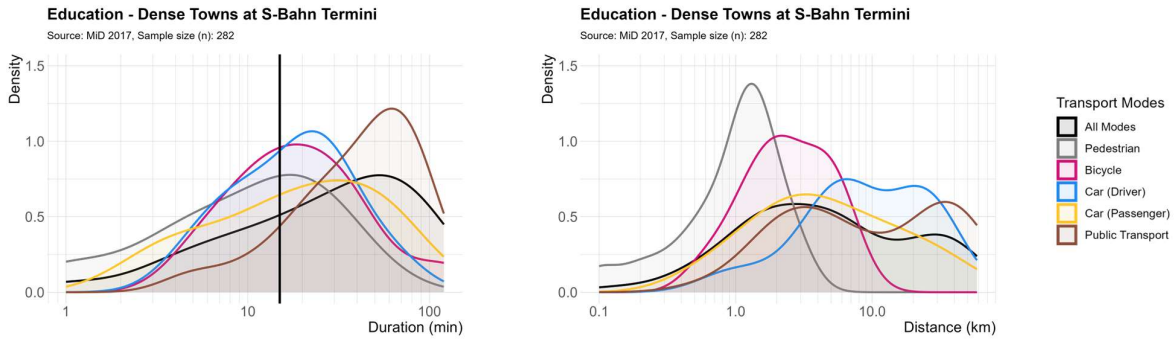
Figure 104: Cumulative distribution function (CDF) of work trip duration (a, b) and distance (c, d)– Dense Towns at S-Bahn Termini

Table 100: Percentage of work trips conducted for different time stamps – Dense Towns at S-Bahn Termini

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	26.3%	37.7%	46.0%	62.7%
Pedestrians	50.0%	65.9%	77.3%	88.6%
Bicycle	53.3%	78.7%	81.3%	96.0%
Car (as Driver)	23.4%	34.4%	45.6%	65.3%
Car (as Passenger)	45.0%	55.0%	65.0%	85.0%
Public Transport	1.9%	2.9%	4.8%	15.4%

9.5.2. Educational trips

The duration of educational trips in Munich's LL location is on average 25 minutes, with a distance covered of approximately 8.5 kilometres. Furthermore, it has been determined that more than 50% of these trips are completed within 15 minutes. Public transport is the predominant mode of transportation, followed by walking and cycling. Trips undertaken by public transport have an average duration of 45 minutes, with almost 13% of them being completed within 15 minutes. In comparison, walking and cycling trips are shorter in both distance and duration, and as expected, more than 65% of them last up to 15 minutes. The results indicate a sufficient degree of proximity to educational institutions, which supports the use of sustainable transport modes.



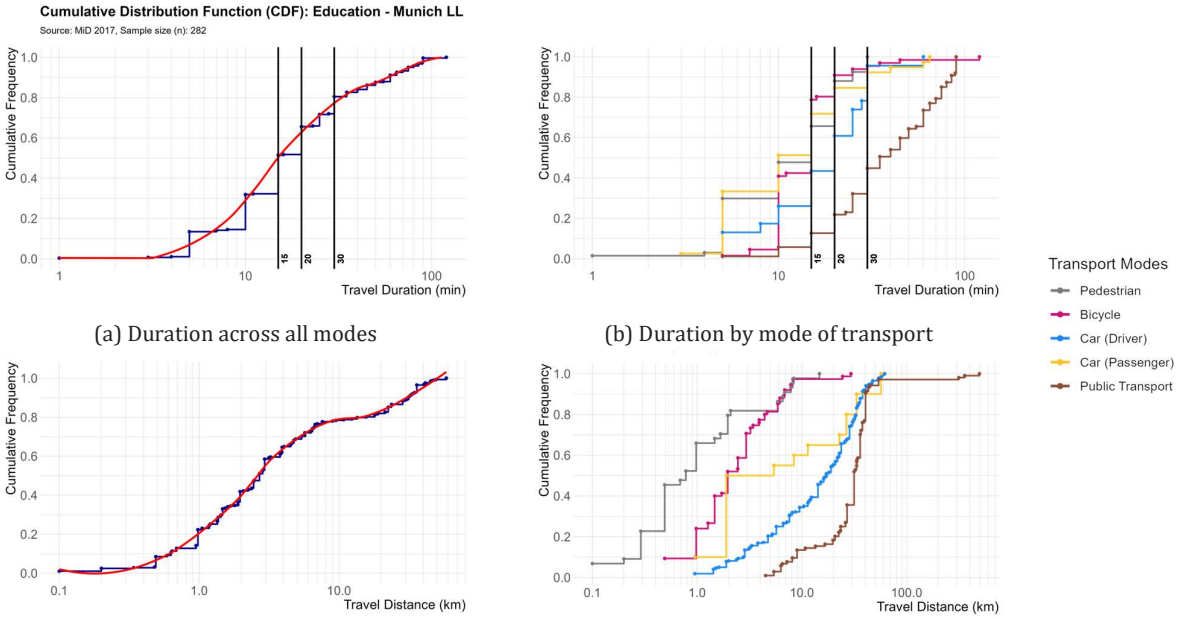
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 105: Density plot of educational trip duration (a) and distance (b) by transport mode – Dense Towns at S-Bahn Termi

Table 101: Educational trip statistics by transport mode – Dense Towns at S-Bahn Termini

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	282	24.63	15.00	21.96	8.53	2.70	12.59
Pedestrians	67	13.73	15.00	7.89	1.04	0.98	0.65
Bicycle	66	16.15	15.00	14.51	2.41	2.45	1.32
Car (as Driver)	23	20.26	20.00	12.17	13.42	7.60	10.25
Car (as Passenger)	39	15.59	10.00	14.01	7.45	3.80	9.96
Public Transport	87	44.68	35.00	25.45	18.13	10.80	16.52



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

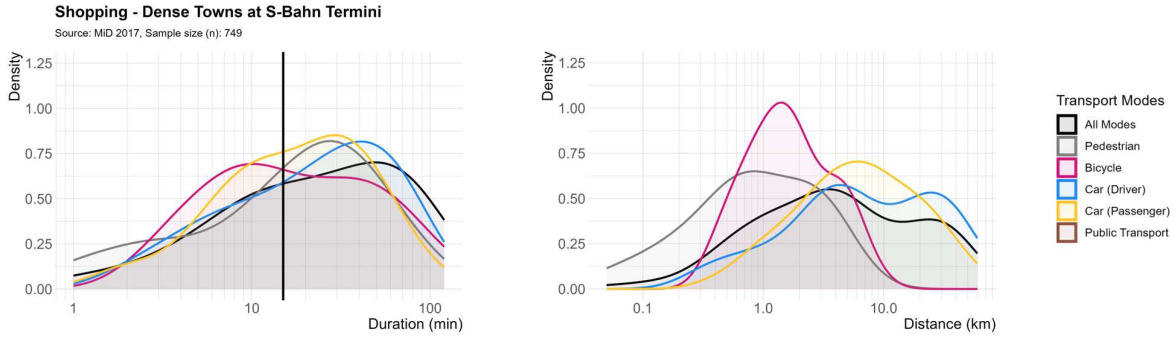
Figure 106: Cumulative distribution function (CDF) of educational trip duration (a, b) and distance (c, d)– Dense Towns at S-Bahn Termini

Table 102: Percentage of educational trips conducted for different time stamps – Dense Towns at S-Bahn Termini

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	31.9%	51.4%	65.6%	80.5%
Pedestrians	47.8%	65.7%	88.1%	100%
Bicycle	40.9%	78.8%	90.9%	95.5%
Car (as Driver)	26.1%	43.5%	60.9%	95.7%
Car (as Passenger)	51.3%	71.8%	84.6%	92.3%
Public Transport	5.7%	12.6%	21.8%	44.8%

9.5.3. Shopping trips

The duration of shopping trips in Munich's LL location is on average 15.5 minutes, with a distance covered of approximately 5.1 kilometres. Furthermore, it is notable that almost 78% of these trips are completed within 15 minutes, indicating a high level of proximity to shopping facilities. The predominant mode of transportation is the car, followed by bicycle and walking. The average duration of car journeys to shopping facilities is 15 minutes, with almost 80% of these journeys lasting less than 15 minutes. In comparison, cycling and walking trips are shorter both in distance and duration. The findings suggest that while residents of Munich's LL location do rely on motorised transport for their shopping trips, a significant proportion of these trips are still made using sustainable transport modes.



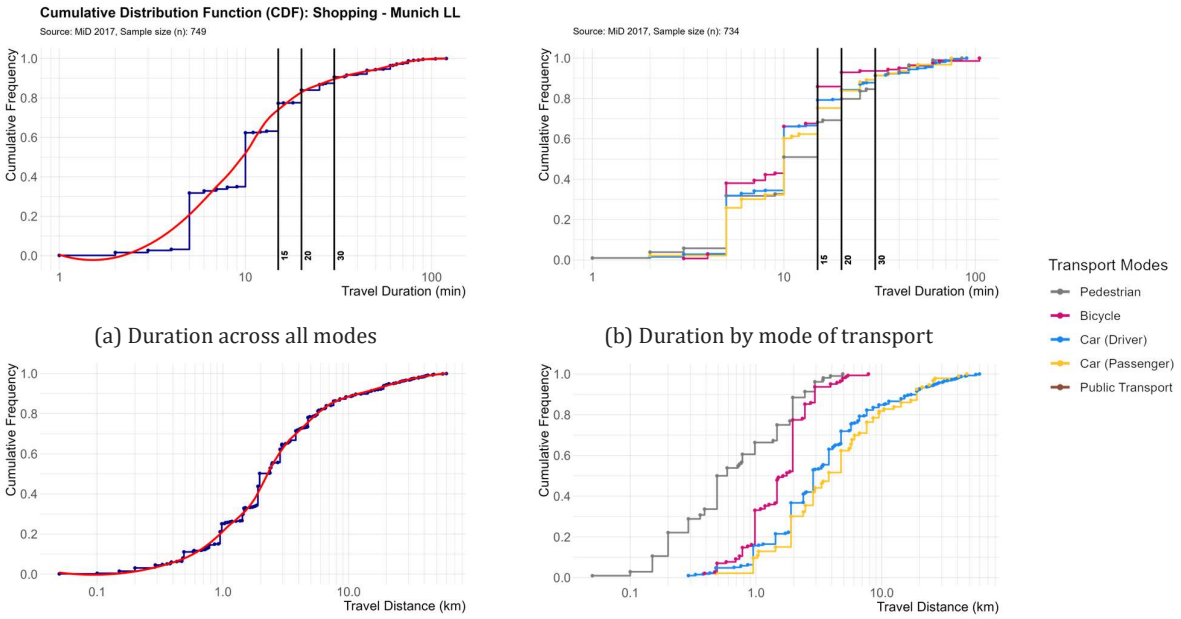
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 107: Density plot of shopping trip duration (a) and distance (b) by transport mode – Dense Towns at S-Bahn Termi

Table 103: Shopping trip statistics by transport mode – Dense Towns at S-Bahn Termini

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	749	15.46	10.00	16.58	5.11	1.96	8.31
Pedestrians	104	16.01	10.00	14.34	1.04	0.54	0.99
Bicycle	142	13.04	10.00	15.08	1.80	1.70	1.12
Car (as Driver)	395	14.62	10.00	14.80	6.39	2.85	9.39
Car (as Passenger)	93	15.10	10.00	14.63	7.03	3.80	8.46
Public Transport	Insufficient sample for analysis						



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

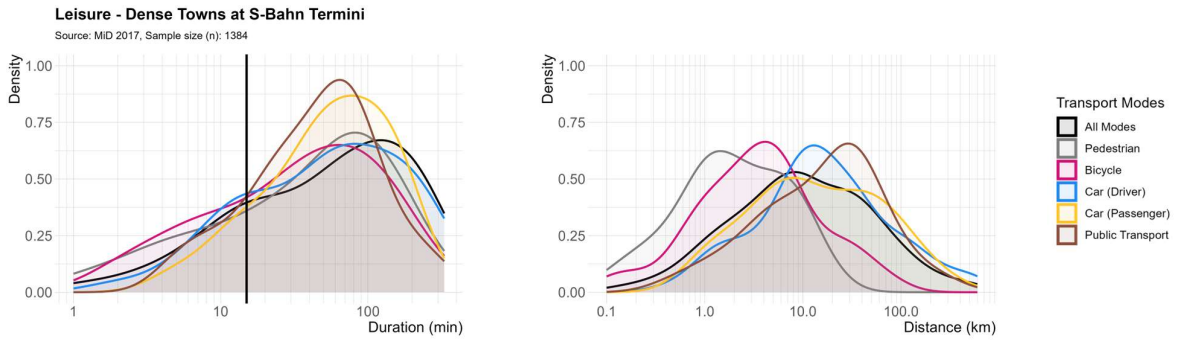
Figure 108: Cumulative distribution function (CDF) of shopping trip duration (a, b) and distance (c, d)– Dense Towns at S-Bahn Termini

Table 104: Percentage of shopping trips conducted for different time stamps – Dense Towns at S-Bahn Termini

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	62.3%	77.3%	83.9%	90.7%
Pedestrians	50.9%	68.3%	79.8%	91.3%
Bicycle	66.2%	85.9%	92.9%	93.7%
Car (as Driver)	66.1%	79.2%	84.3%	91.4%
Car (as Passenger)	60.2%	75.3%	83.9%	91.4%
Public Transport	Insufficient sample size for analysis			

9.5.4. Leisure trips

The residents of Munich's LL location typically travel an average of 31.5 minutes for leisure purposes. According to Table 104, almost 55% of these leisure trips are completed within 15 minutes. The predominant mode of transportation is the automobile, followed by walking. The duration of car journeys is on average 30 minutes, with almost 57% of these lasting up to 15 minutes. In contrast, walking trips are characterised by their duration, albeit covering shorter distances, with almost 49% of them lasting up to 15 minutes. This figure, however, may not necessarily signify a lack of proximity to leisure facilities, but rather, it could be indicative of a distinct preference among Munich's LL for walking as a leisure activity in itself.



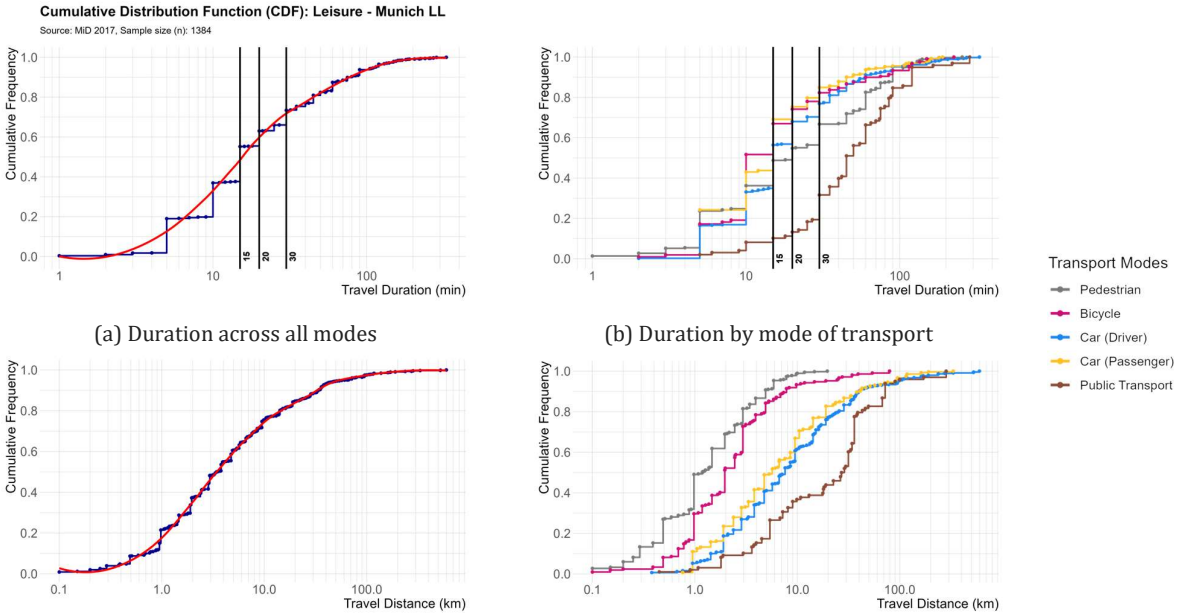
(a) Duration by mode of transport

(b) Distance by mode of transport

Figure 109: Density plot of leisure trip duration (a) and distance (b) by transport mode – Dense Towns at S-Bahn Termi

Table 105: Leisure trip statistics by transport mode – Dense Towns at S-Bahn Termini

Transport Modes	Sample (n)	Duration (min)			Distance (km)		
		Mean	Median	SD	Mean	Median	SD
All Modes	1384	31.43	15.00	39.77	14.90	3.46	42.96
Pedestrians	367	34.93	20.00	37.09	2.08	1.19	2.37
Bicycle	209	26.27	10.00	36.80	4.62	1.96	9.91
Car (as Driver)	438	29.18	15.00	40.88	24.45	7.60	63.96
Car (as Passenger)	272	22.92	15.00	30.73	17.00	5.70	33.98
Public Transport	98	63.02	45.00	54.37	36.26	27.90	51.91



(a) Duration across all modes

(b) Duration by mode of transport

(c) Distance across all modes

(d) Distance by mode of transport

Figure 110: Cumulative distribution function (CDF) of leisure trip duration (a, b) and distance (c, d)– Dense Towns at S-Bahn Termini

Table 106: Percentage of leisure trips conducted for different time stamps – Dense Towns at S-Bahn Termini

Transport Modes	Share of trips with a duration less than (min)			
	10	15	20	30
All Modes	36.9%	55.2%	63.0%	73.4%
Pedestrians	36.2%	48.8%	54.8%	66.8%
Bicycle	51.7%	66.9%	74.2%	82.3%
Car (as Driver)	33.1%	56.4%	68.0%	76.9%
Car (as Passenger)	43.0%	69.1%	75.4%	84.9%
Public Transport	8.2%	10.2%	13.3%	31.6%

9.6.Travel behaviour across different socioeconomic groups

The present section of the analysis is concerned with an examination of modal split and trip characteristics of different socioeconomic groups in Munich. The main findings of the analysis are presented here, but the detailed results of the analysis can be found in **Appendix F** and **G**.

9.6.1.Gender

- Work trips are significantly longer for males than for females, however, for other trip purposes no significant differences have been found.
- In terms of trip duration, there are no statistically significant differences in trip durations between genders for any trip purpose.
- Males tend to drive cars more often, especially for work and shopping trips.
- Females rely more on public transport and walking for their shopping and leisure trips.
- Bicycle usage is fairly balances between genders, but slightly higher of males in education trips.

9.6.2.Income

The dataset categorizes the economic situation of households as very poor, poor, average, good, and very good. For the purpose of the analysis, we have been merged the first two categories (very poor and poor) into a single category called low income, and the last two categories (good and very good) into a single category called high income.

- Low-income individuals spend more time on education and shopping trips, while high-income individuals cover longer distances for work and leisure.
- Work trips are longer in distance for high-income individuals; however, trip duration does not differ significantly.
- Bike usage is higher among high-income individuals, especially for work and education trips.
- High-income individuals use cars more for their shopping and work trips.
- Low-income individuals rely heavily on public transport for all trip purposes.
- People with higher incomes are more likely to walk to educational institutions.

9.6.3.Age

In order to analyse travel behaviour across age in Munich, the sample has been divided into four groups. The groups are the following:

1. Children/Students (up to 17 years old)
2. Young adults (18 to 39 years old)
3. Middle-aged adults (40 to 59 years old)
4. Old adults (over 60 years old)

- Trip duration shows significant variations across age groups for education, shopping and leisure trips.
- Trip distance shows significant differences for education and leisure trips, but no significant differences for shopping and work trips.
- Middle-aged adults and old adults use cars more for their work and shopping trips.

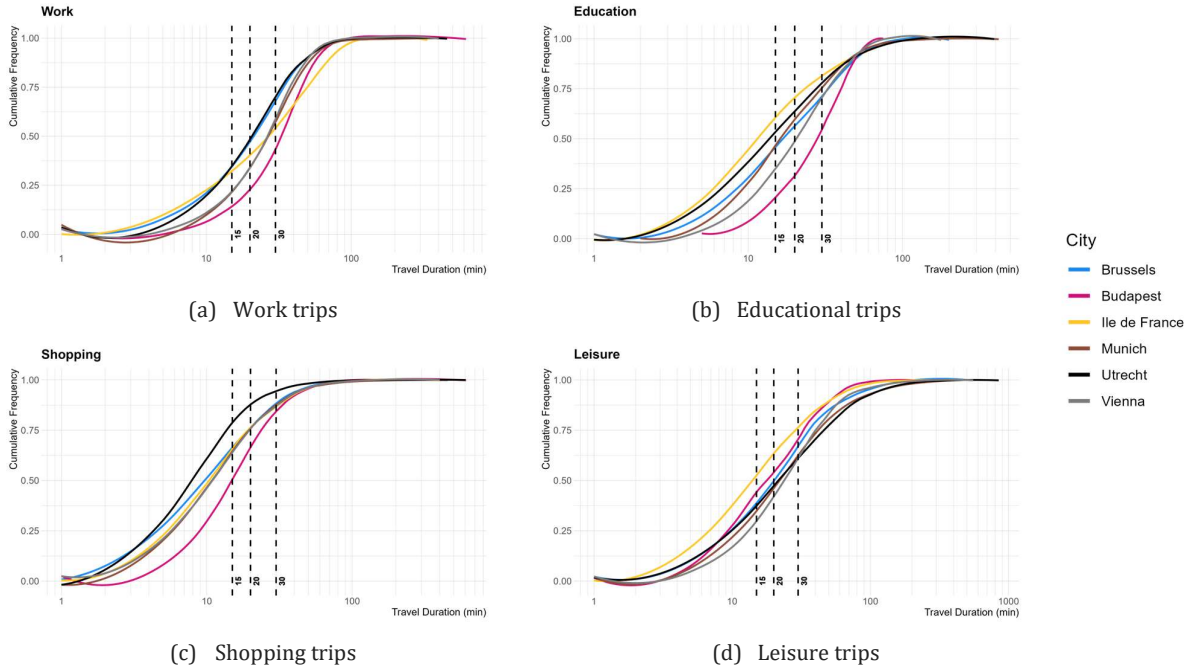
- Children and young adults rely more on public transportation for their education trips.
- The age group with the highest share of walking trips to shopping facilities is the one of young adults.
- Bike usage is higher among children/students and middle-aged adults.

10. COMPARISON

This chapter undertakes a comparative analysis of the travel behaviour exhibited by the inhabitants of the cities and Living Labs under review.

10.1. City level

Figure 111 presents the Cumulative Distribution Functions (CDF) for the city level, categorized according to trip purpose, and Tables 107 to 110 present the percentage of work, educational, shopping, and leisure trips conducted for different time stamps.



(a) Work trips (b) Educational trips

(c) Shopping trips (d) Leisure trips

Figure 111: Cumulative distribution function (CDF) of trip duration per trip purpose– City level

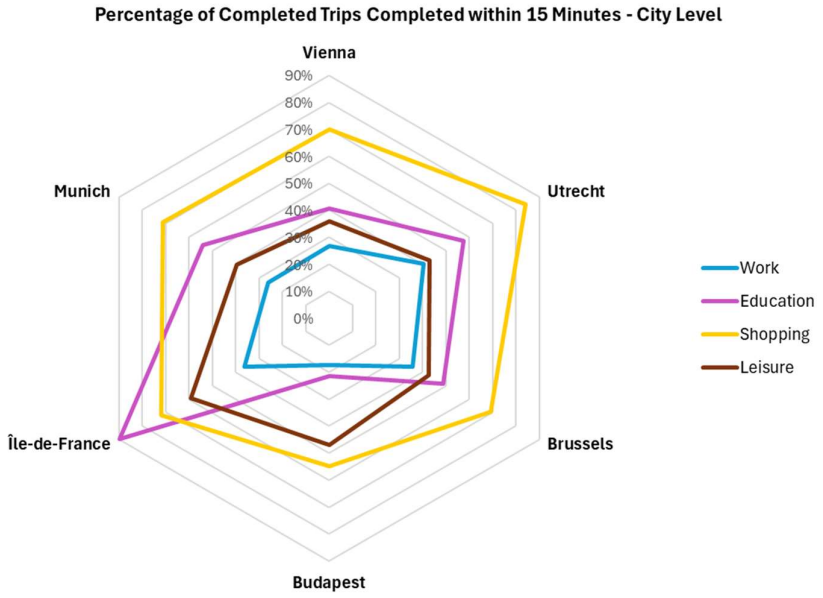


Figure 112: Percentage of trips completed within 15 minutes by trip purpose - City level

Work trips

The results of the study demonstrate a divergence in the alignment of work trips with the 15-Minute City (15mC) concept. The city of Utrecht exhibits the strongest alignment with this concept, with 40.5% of work-related trips lasting less than 15 minutes and 75.8% taking less than 30 minutes. This suggests that the urban design of Utrecht is more compact, facilitating efficient access to workplaces. Brussels is a close second with 35.9% of trips being completed within 15 minutes, though a greater proportion of these trips are completed within the 30-minute time range. Île-de-France, in spite of its status as a vast metropolitan zone, demonstrates that 36.2% of journeys are executed within a time span of 15 minutes, whilst a notable proportion of 58.5% falls within a 30-minute time frame. Munich and Vienna demonstrate moderate alignment with the concept, with approximately 26-27% of trips falling under 15 minutes, and substantial proportions extending beyond 30 minutes (63.7% and 65.3%, respectively). Budapest, with its 17.4% of short-duration trips (under 15 minutes) and 49.6% of trips under 30 minutes, appears to be the furthest from fully embracing the 15mC concept. Overall, Utrecht stands out as the closest match, while Budapest shows the least alignment. In regard to the modal split, individuals in Vienna, Brussels and Munich demonstrate a greater reliance on public transport and cars for their commutes, in comparison to individuals in Utrecht, Budapest, and the Île-de-France region, where there is a preference for motorized transport.

Table 107: Percentage of work trips conducted for different time stamps – City level

City	Share of work trips with a duration less than (min)			
	10	15	20	30
Vienna	14.3%	26.9%	38.6%	65.3%
Utrecht	23.3%	40.5%	52.2%	75.8%
Brussels	23.5%	35.9%	49.5%	68.5%
Budapest	10.5%	17.4%	27.8%	49.6%
Île-de-France	26.8%	36.2%	43.5%	58.5%
Munich	13.7%	26.2%	37.4%	63.7%

Educational trips

A comparison of these cities in relation to the 15-Minute City concept reveals Île-de-France to be the most accomplished region in this regard, with a noteworthy 89.7% of trips taking under 15 minutes and almost all (99.4%) taking under 30 minutes. This finding suggests the presence of a well-distributed educational infrastructure in the whole region. Utrecht also reveals notable performance, with 57.5% of trips completed within 15 minutes and 80.8% within 30 minutes. Munich and Brussels demonstrate moderate alignment, with approximately 50% of educational trips completed within 15 minutes and around 70-80% within 30 minutes. Vienna also displays a comparable tendency, with 40.5% of trips lasting less than 15 minutes and 74% lasting less than 30 minutes. On the other hand, Budapest exhibits the least degree of alignment with only 21.6% of educational trips falling within the under 15 minutes bracket and just 56.8% within the under 30 minutes bracket. Overall, Île-de-France and Utrecht appear closest to the ideal of 15-minute city centres (15mC), where the majority of students can access educational facilities efficiently, whereas Budapest falls behind. However, the absence of students under the age of 18 in the Budapest dataset precludes the possibility of deriving any meaningful insights regarding the degree of proximity to primary and secondary educational institutions in Budapest. With respect to the modal split, students in Vienna, Brussels, Budapest and Munich demonstrate a greater propensity for utilising public transportation to access educational institutions, in contrast to their counterparts in Utrecht and the Île-de-France region, where cycling and walking are preferred modes of transportation, respectively.

Table 108: Percentage of educational trips conducted for different time stamps – City level

City	Share of educational trips with a duration less than (min)			
	10	15	20	30
Vienna	24.6%	40.5%	53.0%	74.0%
Utrecht	44.3%	57.5%	67.1%	80.8%
Brussels	33.1%	48.7%	56.9%	71.7%
Budapest	8.1%	21.6%	35.1%	56.8%
Île-de-France	73.3%	89.7%	95.9%	99.4%
Munich	33.4%	54.2%	63.7%	79.5%

Shopping trips

In terms of shopping trips, Utrecht once again exhibits a high degree of alignment with the 15mC concept, with 84.1% of trips being completed within 15 minutes and 96.1% of trips taking no more than 30 minutes. This finding suggests a high level of proximity to shopping facilities in Utrecht. Vienna, Munich, the Île-de-France region and Brussels follow closely behind, with approximately 70% of shopping trips completed within 15 minutes and around 90% within 30 minutes. This finding indicates that these cities also exhibit a high degree of commercial proximity. Budapest, while maintaining a majority of trips within 30 minutes (87.4%), exhibits deficiencies in shorter trip durations, with only 55% under 15 minutes and 37.7% under 10 minutes. Consequently, it is evident that Utrecht exhibits optimal proximity for shopping, whilst Budapest remains the least aligned, although all cities demonstrate relatively satisfactory access to shopping opportunities. Furthermore, with respect to modal split, individuals in all cities except Utrecht demonstrate a preference for walking when accessing shopping facilities. In Utrecht, however, the preferred options are cycling, driving or walking.

Table 109: Percentage of shopping trips conducted for different time stamps – City level

City	Share of shopping trips with a duration less than (min)			
	10	15	20	30
Vienna	52.1%	69.9%	79.5%	90.1%
Utrecht	67.8%	84.1%	90.0%	96.1%
Brussels	55.0%	69.3%	78.3%	90.0%
Budapest	37.7%	55.0%	72.6%	87.4%
Île-de-France	54.4%	72.0%	79.9%	90.1%
Munich	52.05	71.3%	79.4%	90.6%

Leisure trips

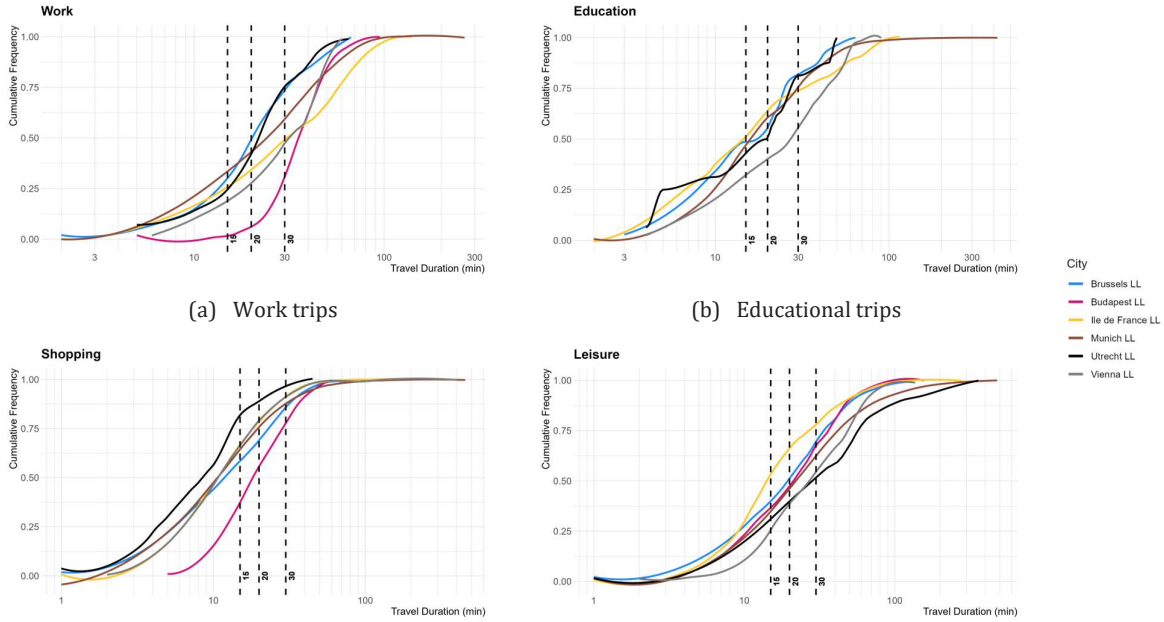
In terms of leisure trips, the Île-de-France region aligns most closely with the 15-Minute City (15mC) concept, with 59.2% of trips completed within 15 minutes and 80.8% within 30 minutes. This suggests a high degree of proximity to recreational spaces. Budapest also performs satisfactorily, where 47% of leisure trips are completed within 15 minutes and 75% within 30 minutes. Brussels and Utrecht exhibit analogous trends, with approximately 42-43% of trips falling within the 15-minute mark and around two-thirds of all trips taking up to 30 minutes. Conversely, Vienna and Munich exhibit the lowest proportions of short leisure trips, with approximately 36-40% of trips falling under 15 minutes and around 67% within 30 minutes. In conclusion, Île-de-France demonstrates the highest degree of proximity to recreational facilities among the other cities. With respect to the modal split, the predominant mode of transportation for leisure travel in all cities is walking.

Table 110: Percentage of leisure trips conducted for different time stamps – City level

City	Share of leisure trips with a duration less than (min)			
	10	15	20	30
Vienna	20.1%	36.0%	46.6%	67.0%
Utrecht	27.1%	43.0%	50.1%	66.6%
Brussels	27.9%	42.5%	52.4%	70.3%
Budapest	35.1%	47.0%	57.7%	75.0%
Île-de-France	42.1%	59.2%	66.4%	80.8%
Munich	24.3%	39.7%	48.9%	67.8%

10.2. Outskirts (Living Lab) level

Figure 113 presents the Cumulative Distribution Functions (CDF) for the outskirts (Living Lab) level, categorized according to trip purpose, and Tables 111 to 114 present the percentage of work, educational, shopping, and leisure trips conducted for different time stamps.



(a) Work trips (b) Educational trips

(c) Shopping trips (d) Leisure trips

Figure 113: Cumulative distribution function (CDF) of trip duration per trip purpose– Outskirts (Living Lab) level

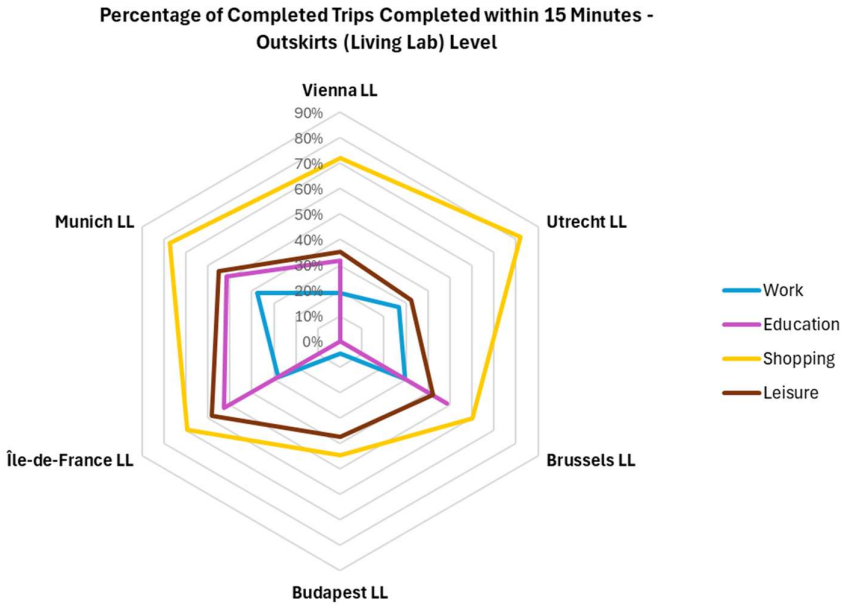


Figure 114: Percentage of trips completed within 15 minutes by trip purpose – Outskirts (Living Lab) level

Work trips

An analysis of work trip durations in the Living Labs (LL) reveals that Munich LL exhibits the closest alignment with the 15mC concept, with 37.7% of trips lasting less than 15 minutes and 62.7% occurring within 30 minutes, suggesting enhanced local job accessibility. A similar performance is observed in Brussels LL, with 29.7% of work trips falling under the 15-minute threshold and 74.3% within the 30-minute range. The Utrecht LL exhibits moderate alignment, with 26.7% of work trips falling under 15 minutes and a substantial 76.7% within 30 minutes. In contrast, the Île-de-France LL and Vienna LL exhibit comparatively lower percentages of short-duration commutes, with approximately 19-28% falling under the 15-minute category and around 50% within a 30-minute radius. This indicates a more dispersed distribution of employment centers in these regions. The Budapest LL exhibits the most lacking performance, with only 4.9% of trips occurring under 15 minutes and a mere 37.2% under 30 minutes, underscoring substantial challenges in local job accessibility. In conclusion, the Munich LL demonstrates the strongest alignment with the 15mC vision, while the Budapest LL exhibits the least alignment.

Table 111: Percentage of work trips conducted for different time stamps – Outskirts (Living Lab) level

Living Lab	Share of work trips with a duration less than (min)			
	10	15	20	30
Vienna	11.8%	19.1%	30.9%	50.0%
Utrecht	13.3%	26.7%	40.0%	76.7%
Brussels	18.9%	29.7%	54.1%	74.3%
Budapest	1.7%	4.9%	10.1%	37.2%
Île-de-France	18.1%	28.1%	36.7%	51.8%
Munich	26.3%	37.7%	46.0%	62.7%

Educational trips

In the Living Labs, Île-de-France and Munich exhibit the most robust alignment with the 15mC concept for educational excursions. Île-de-France distinguishes itself with 52.5% of trips completed within 15 minutes and 74% within 30 minutes, reflecting a well-distributed network of schools and universities. Munich exhibits a similar performance, with 51.4% of trips completed in under 15 minutes and 80.5% within 30 minutes, suggesting a comparable level of accessibility. Brussels also demonstrates a positive performance with 48.6% of trips completed within 15 minutes and 80% within 30 minutes. Conversely, Vienna exhibits a comparatively lower level of accessibility, with only 31.8% of educational trips falling within 15 minutes and 56.8% within 30 minutes, suggesting a less evenly distributed educational infrastructure. Notably, data concerning Utrecht and Budapest is unavailable due to insufficient sample size, impeding comprehensive comparative analyses. Overall, the Île-de-France LL and Munich LL appear to best support the 15mC vision for education.

Table 112: Percentage of educational trips conducted for different time stamps – Outskirts (Living Lab) level

Living Lab	Share of educational trips with a duration less than (min)			
	10	15	20	30
Vienna	20.5%	31.8%	40.9%	56.8%
Utrecht	-	-	-	-
Brussels	34.3%	48.6%	54.3%	80.0%
Budapest	-	-	-	-
Île-de-France	43.6%	52.5%	67.2%	74.0%
Munich	31.9%	51.4%	65.6%	80.5%

Shopping trips

Among the Living Labs, Utrecht and Munich demonstrate optimal accessibility for shopping trips in accordance with the 15mC concept. Utrecht demonstrates a noteworthy distinction with 81.9% of trips completed within 15 minutes and an impressive 97.9% within 30 minutes, underscoring its robust retail accessibility. Munich exhibits a comparable performance, with 77.3% of trips completed in under 15 minutes and 90.7% within 30 minutes, suggesting a well-distributed commercial network. Vienna and Île-de-France also demonstrate commendable performance, with approximately 70% of trips occurring within 15 minutes and over 90% within 30 minutes, indicating convenient access to shopping destinations. Conversely, Brussels exhibits a slightly lower performance, with only 60.3% of trips falling under 15 minutes and 86.8% within 30 minutes. Budapest exhibits the least efficient performance, with only 44.8% of shopping trips under 15 minutes and 81% within 30 minutes, indicating a less compact retail infrastructure. In conclusion, it is evident that the Utrecht LL and the Munich LL most closely align with the 15mC principles for shopping accessibility.

Table 113: Percentage of shopping trips conducted for different time stamps – Outskirts (Living Lab) level

Living Lab	Share of shopping trips with a duration less than (min)			
	10	15	20	30
Vienna	52.1%	71.9%	79.2%	93.8%
Utrecht	62.8%	81.9%	89.4%	97.9%
Brussels	48.8%	60.3%	71.1%	86.8%
Budapest	17.2%	44.8%	58.6%	81.0%
Île-de-France	49.5%	69.3%	80.2%	93.9%
Munich	62.3%	77.3%	83.9%	90.7%

Leisure trips

For leisure trips in the Living Labs, Île-de-France and Munich show the strongest alignment with the 15mC concept. Île-de-France leads with 58.2% of trips within 15 minutes and 82.2% within 30 minutes, indicating widespread access to recreational opportunities. Munich follows closely, with 55.2% of trips less than 15 minutes and 73.4% within 30 minutes, suggesting a well-distributed network of leisure destinations. Brussels and Budapest show moderate accessibility, with about 42% and 37.5% of trips under 15 minutes, respectively, and nearly 70% within 30 minutes. Utrecht LL and Vienna LL rank lowest, with only about a third of leisure trips within 15 minutes and just over half within 30 minutes, suggesting a more limited proximity to leisure destinations. Overall, the Île-de-France LL and the Munich LL best support the 15mC vision for leisure accessibility.

Table 114: Percentage of leisure trips conducted for different time stamps – Outskirts (Living Lab) level

Living Lab	Share of leisure trips with a duration less than (min)			
	10	15	20	30
Vienna	10.6%	35.1%	42.6%	58.5%
Utrecht	17.5%	32.5%	40.0%	55.0%
Brussels	29.9%	42.1%	54.2%	73.8%
Budapest	25.0%	37.5%	48.9%	69.3%
Île-de-France	39.3%	58.2%	69.4%	82.2%
Munich	36.9%	55.2%	63.0%	73.4%

11. CONCLUSIONS

The comparative analysis conducted in this document, presented a clear difference between the accessibility of short trips at the city level versus the outskirts (Living Lab) level.

In terms of work-related travel, the city of Vienna shows limited accessibility for short work trips, both within the city center and in its peripheral regions. A significant decrease in accessibility is observed in the Living Lab area, indicating a concentration of work-related facilities in certain areas, requiring longer commutes. Viennese residents rely mainly on public transport for their commutes, while in the Living Lab region there is a shift towards car use. In Utrecht, the city level shows better accessibility for short commutes compared to the outskirts, but accessibility for work trips remains low, suggesting that jobs are more concentrated in the urban core. Concernign the modal split, the car is the dominant mode for commuting in both the city and the Living Lab region. In the case of Brussels, accessibility for short commutes is moderate at the city level, but decreases in the suburbs, while individuals choose public transport for their commutes. Budapest shows the weaker performance for short work trips at both the city and suburban levels, highlighting a strong reliance on longer commutes to reach employment centers. Individuals in Budapest commute mainly by car, however, in the ourtskirts it is noticed a shift towards public transport The Île-de-France region performs moderately well at the city level but experiences a notable decline in accessibility in the suburbs, while car is the dominant mode for daily commutes. Finally, Munich has one of the best performances for short work trips, particularly in the suburbs, and is the only city where suburban work trip accessibility is higher than the city. The modal split shows that people in the city of Munich prefer to use public transport for commuting, while in the suburbs there is a shift towards motorized transport.

Regarding educational travel, the results in Vienna indicate that students living outside the city center have to travel longer to reach an educational destination. For the case of Utrecht and Budapest, due to the insufficient sample size for the Living Lab area, the analysis cannot provide us with a fruitful result, however, the city of Budapest shows the weaker performance for short trips to educational institutions. In Brussels and Munich accessibility remains fairly high and the results show minimal disparity between central and suburban areas. The Île-de-France city region is the top performer in education accessibility, however, there is a notable decline in the accessibility of schools in the suburbs. Concering modal split, individuals in Vienna, Brussels, Budapest, Île-de-France, and Munich rely on walking and public transport for educational trips, while cycling is the dominant mode in Utrecht.

Regarding shopping trips, the cities of Vienna, Utrechts, Brussels, Budapest and Île-de-France perform satisfactorily in terms of shopping accessibility, while the results show minimal differences between central and suburban areas. Utrecht is the best performer in terms of shopping accessibility, suggesting a well-distributed retail infrastructure. On the other hand, Budapest shows the weaker performance, indicating a lack of nearby retail options in both the city and suburbs. Munich results indicate well-distributed retail options even in suburban areas. In terms of modal split, walking is the dominant mode for shopping trips in most cities, with the exception of Utrecht where people prefer to cycle. In the Living Lab regions of Vienna, Budapest, Île-de-France and Munich there is a shift towards car use, while in the Living Lab regions of Utrecht and Brussels people prefer to walk.

Finally, with regard to leisure, the results for Vienna, Brussels and Île-de-France indicate that access to leisure facilities remains fairly balanced between urban and suburban areas. In Budapest, there is a marked decline in the accessibility of leisure facilities in the suburbs, while in Munich the results indicate that the accessibility of leisure facilities in the suburbs exceeds that of the city. The Île-de-France urban region is once again the top performer in terms of leisure accessibility, while Vienna is the weaker performer, indicating fewer local leisure facilities, especially in the suburbs. In most cities and Living Labs, walking is the dominant mode for leisure trips, but in the Living Lab areas of Brussels and Munich, people tend to visit leisure facilities by car.

Overall, the results show a high degree of car dependency in the suburbs for everyday trips and especially for shopping trips, which underlines the need to improve suburban accessibility to all kinds of essential facilities. Of course, the results of this analysis are limited by certain constraints, such as the outdated travel data sets for Vienna, Munich and Budapest. These household surveys were conducted before the COVID-19 pandemic and are unable to reflect the impact of the pandemic on travel behavior.

Furthermore, as the analysis zooms in on small regions of the cities, and especially in the outskirts, the sample size in some datasets was insufficient for analysis, forcing us to expand the analyzed region of the Living Labs. However, the fruitful results presented in this report can serve as a baseline for understanding travel behavior, and thus help evaluate new policies and interventions related to the 15-minute city concept.

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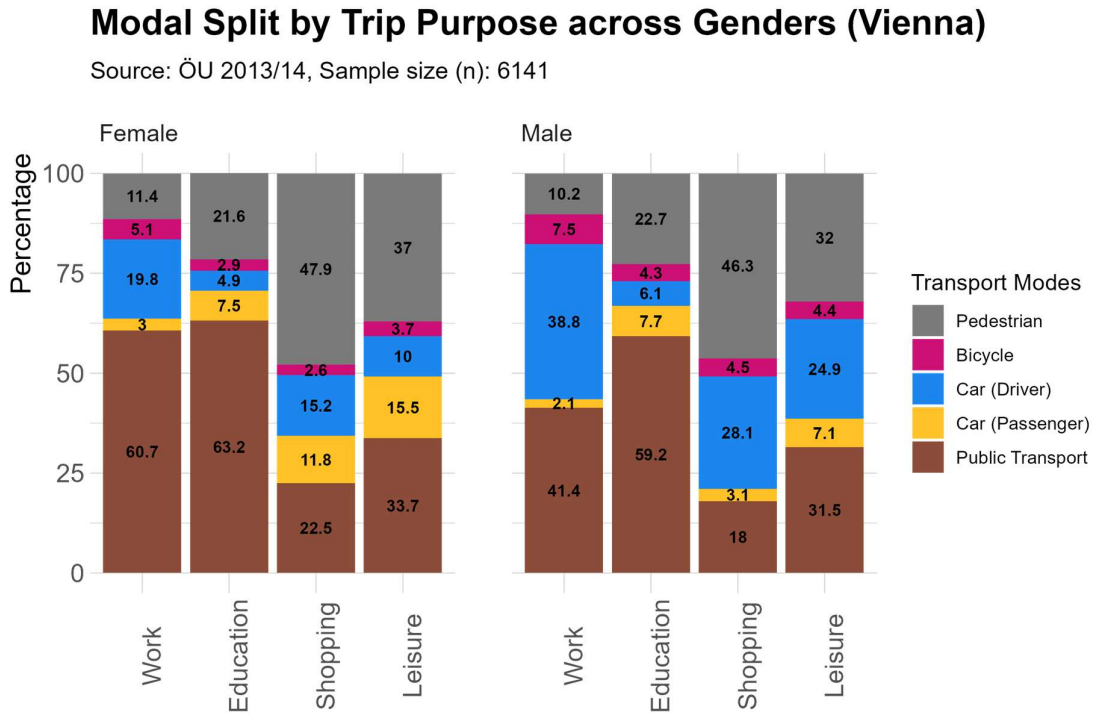
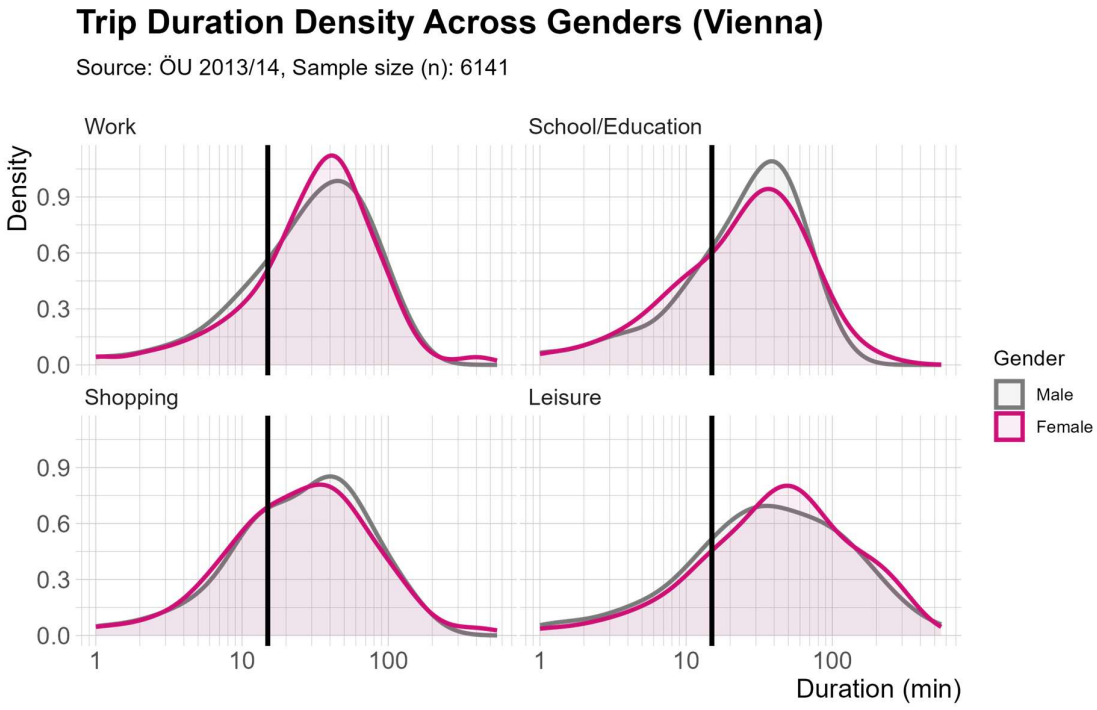
APPENDIX A

Vienna

Gender



A1: Modal split across genders – Vienna



A2: Trip duration density across genders and trip purposes - Vienna

A3: Trip duration statistics across genders – Vienna

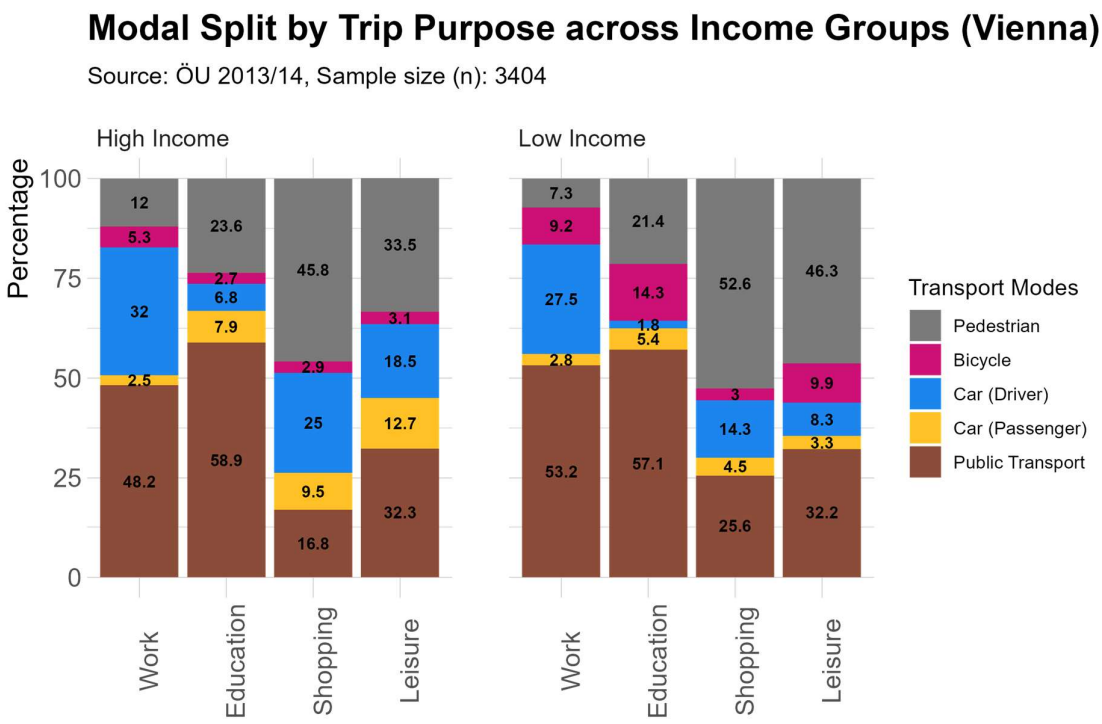
Trip Purpose	Gender	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Male**	899	29.3	17.8	-0.392	0.695
	Female	1848	29.6	21.6		
Education	**Male**	326	24.4	16.3	-0.569	0.569
	Female	696	25.2	17.8		
Shopping	**Male**	737	16.8	17.8	0.554	0.579
	Female	2012	16.3	20.3		
Leisure	**Male**	902	33.2	37.5	-0.057	0.954
	Female	1998	33.2	33.6		

A4: Trip distance statistics across genders - Vienna

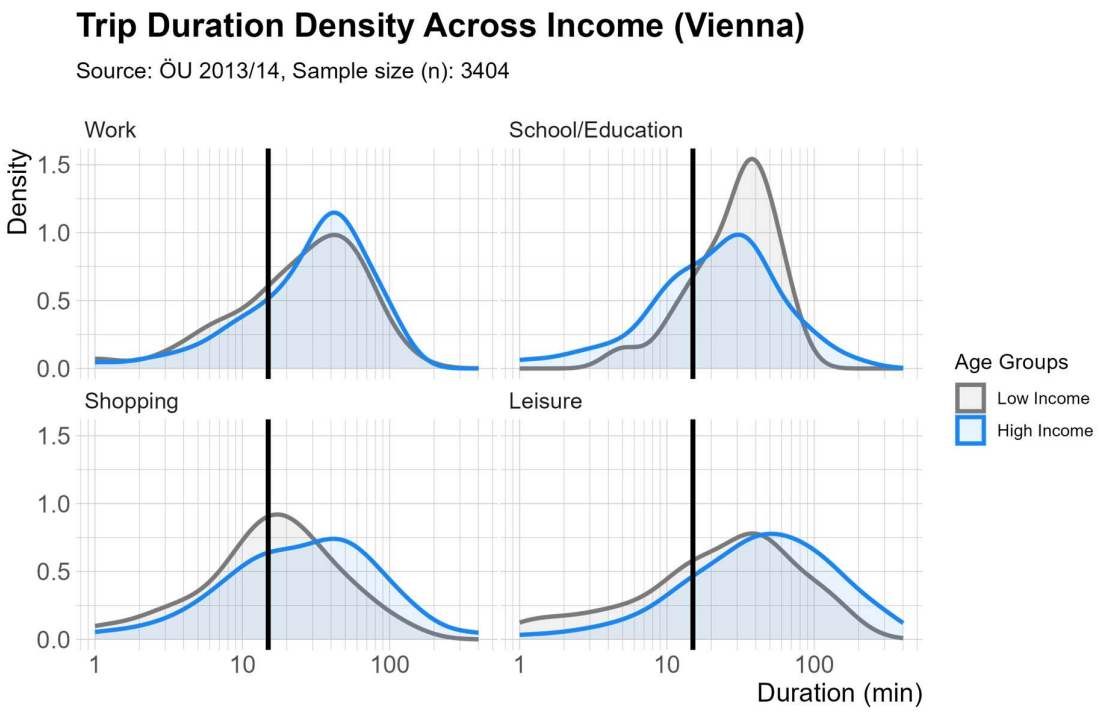
Trip Purpose	Gender	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Male**	899	10.7	13.9	3.754	**<0.05***
	Female	1848	8.5	11.4		
Education	**Male**	326	6.2	9.4	0.112	0.911
	Female	696	6.1	8.9		
Shopping	**Male**	737	4.1	9.2	1.100	0.272
	Female	2012	3.6	8.0		
Leisure	**Male**	902	11.5	37.2	1.134	0.257
	Female	1998	9.8	28.8		

Significance level (*p*-value): *≤0.05 (5%)

Income



A5: Modal split across income groups - Vienna



A6: Trip duration density across income groups and trip purposes - Vienna

A7: Trip duration statistics across income groups – Vienna

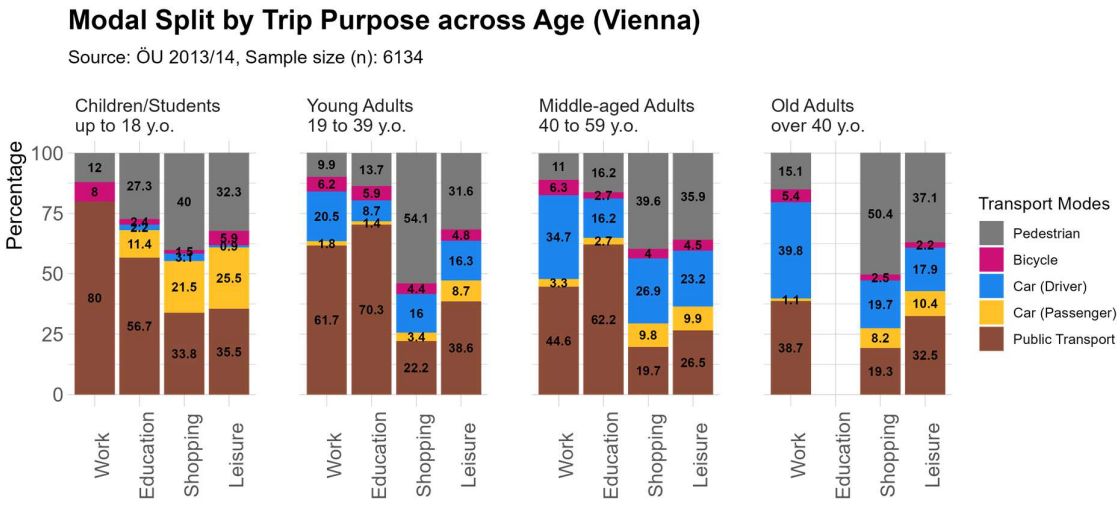
Trip Purpose	Income Group	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Low**	109	32.0	19.7	1.828	0.069
	High	2772	28.4	17.2		
Education	**Low**	56	27.8	16.9	1.535	0.129
	High	876	23.9	18.8		
Shopping	**Low**	133	15.2	15.2	-0.423	0.672
	High	2304	15.8	21.0		
Leisure	**Low**	121	32.4	29.3	0.140	0.889
	High	3003	32.0	34.6		

Significance level (*p*-value): *≤0.05 (5%)

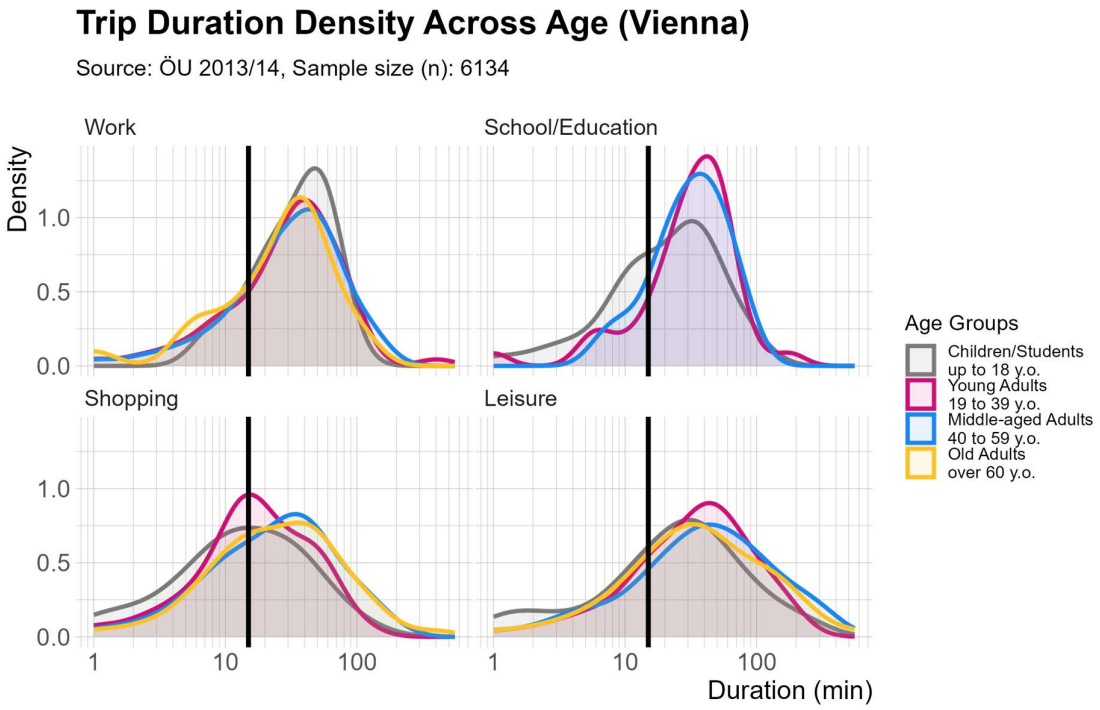
A8: Trip distance statistics across income groups - Vienna

Trip Purpose	Income Group	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Low**	109	10.0	9.6	0.637	0.525
	High	2772	9.4	12.9		
Education	**Low**	56	6.4	6.6	0.440	0.661
	High	876	5.9	11.1		
Shopping	**Low**	133	3.0	4.3	-1.527	0.128
	High	2304	3.7	7.7		
Leisure	**Low**	121	4.9	9.5	-4.449	**<0.05***
	High	3003	11.2	34.9		

Significance level (*p*-value): *≤0.05 (5%)



A9: Modal split across age groups - Vienna



A10: Trip duration density across age groups and trip purposes - Vienna

A11: Trip duration statistics across age groups – Vienna

Trip Purpose	Age Group	N	Mean (min)	SD	*Pr(>F)*
Work	**1**	25	38.4	17.5	**0.009****
	2	679	30.8	22.2	
	3	1026	28.4	18.1	
	4	93	29.0	18.6	
Education	**1**	411	21.1	15.3	**<0.001*****
	2	219	30.5	18.1	
	3	37	33.5	18.6	
	4	Insufficient sample size for analysis			
Shopping	**1**	65	16.2	13.5	0.056
	2	388	14.4	13.4	
	3	579	16.4	18.0	
	4	711	17.7	23.0	
Leisure	**1**	220	27.5	29.1	**<0.001*****
	2	516	28.6	23.9	
	3	577	35.4	41.5	
	4	588	17.7	23.0	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

A12: Trip distance statistics across age groups – Vienna

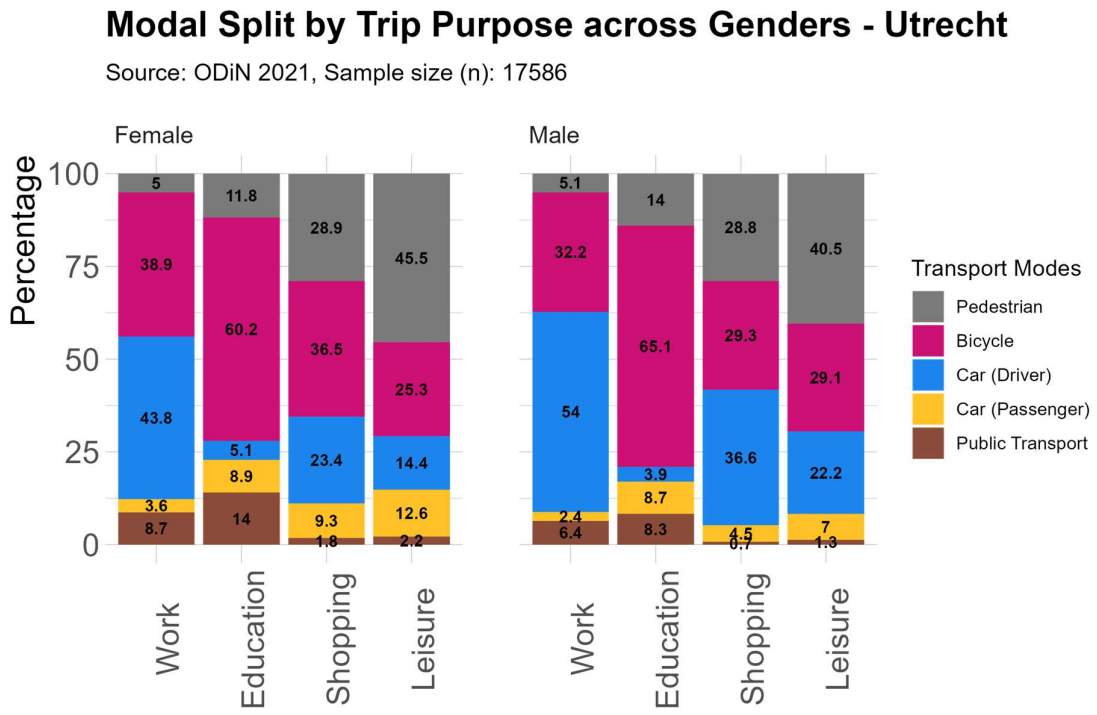
Trip Purpose	Age Group	N	Mean (km)	SD	*Pr(>F)*
Work	**1**	25	9.1	6.6	0.476
	2	679	10.1	15.0	
	3	1026	9.2	10.3	
	4	93	9.9	19.8	
Education	**1**	411	5.1	9.7	**0.003****
	2	219	7.4	7.7	
	3	37	10.9	9.9	
	4	Insufficient sample size for analysis			
Shopping	**1**	65	3.6	3.6	**0.044***
	2	388	3.3	6.6	
	3	579	4.6	10.8	
	4	711	3.4	7.6	
Leisure	**1**	220	7.3	14.1	**0.013***
	2	516	7.5	12.3	
	3	577	12.6	39.3	
	4	588	3.4	7.6	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

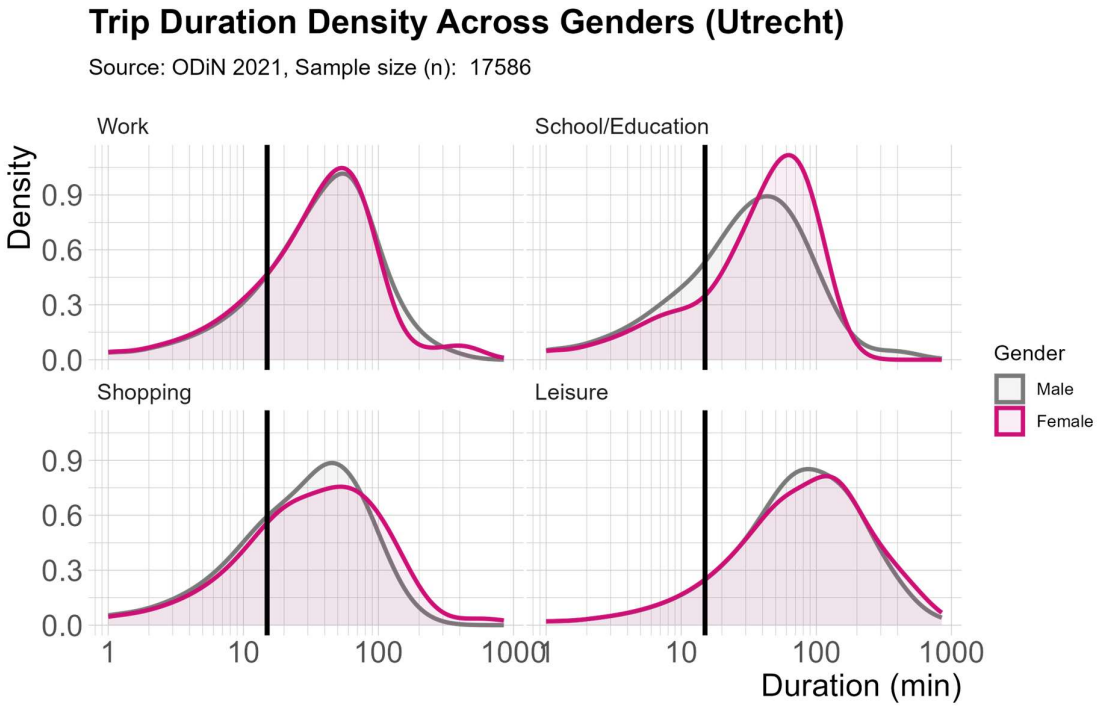
APPENDIX B

Utrecht

Gender



B1: Modal split across genders – Utrecht



B2: Trip duration density across genders and trip purposes - Utrecht

B3: Trip duration statistics across genders – Utrecht

Trip Purpose	Gender	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Male**	1336	26.52	21.20	1.183	0.237
	Female	1243	25.46	23.86		
Education	**Male**	564	20.55	24.56	-1.443	0.149
	Female	644	22.48	21.57		
Shopping	**Male**	2478	11.87	11.82	-1.184	0.236
	Female	2951	12.33	16.74		
Leisure	**Male**	4082	37.61	48.67	-0.179	0.857
	Female	4288	37.80	47.29		

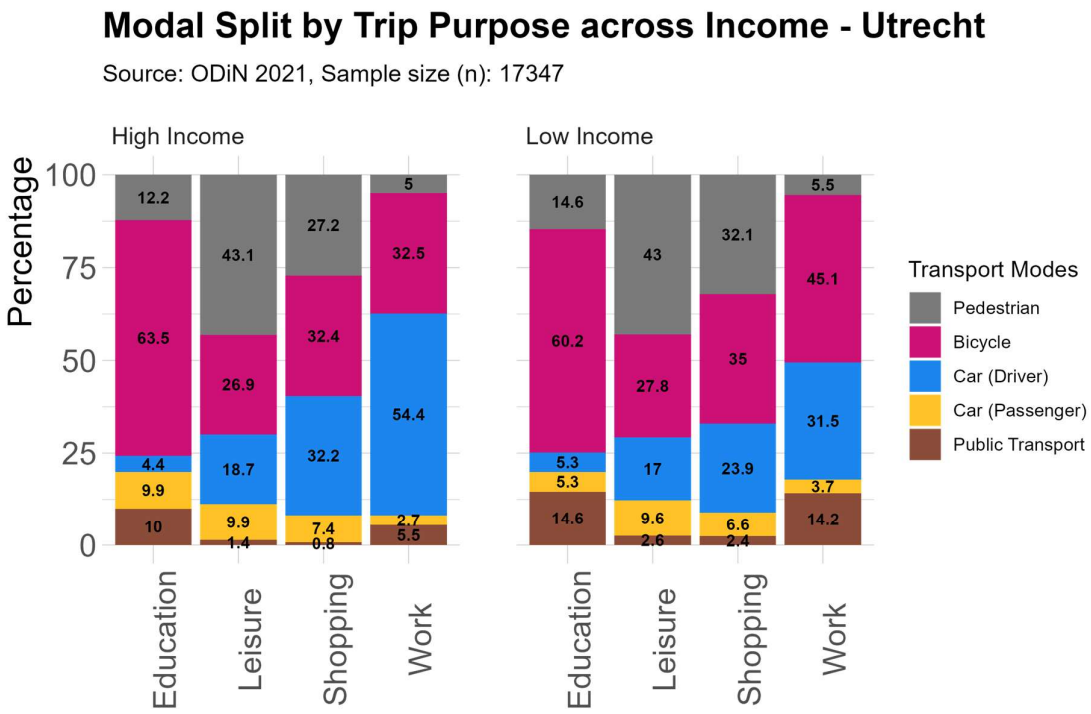
Significance level (*p*-value): *≤0.05

B4: Trip distance statistics across genders – Utrecht

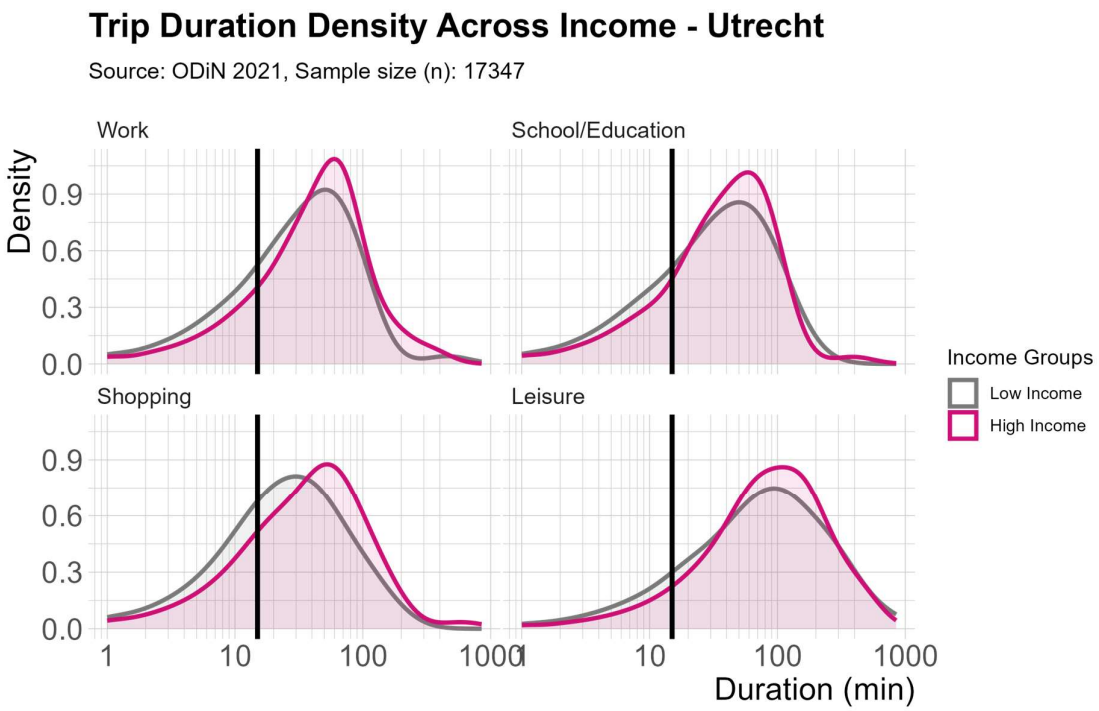
Trip Purpose	Gender	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Male**	1336	16.92	20.19	4.669	**<0.05***
	Female	1243	13.54	16.47		
Education	**Male**	564	6.66	13.06	-0.848	0.397
	Female	644	7.28	12.06		
Shopping	**Male**	2478	3.50	6.74	1.109	0.268
	Female	2951	3.29	7.52		
Leisure	**Male**	4082	8.98	17.17	1.099	0.272
	Female	4288	8.56	17.68		

Significance level (*p*-value): *≤0.05

Income



B5: Modal split across income groups - Utrecht



B6: Trip duration density across income groups and trip purposes - Utrecht

B7: Trip duration statistics across income groups – Utrecht

Trip Purpose	Income Group	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Low**	543	26.32	26.51	0.375	0.708
	High	2013	25.86	21.29		
Education	**Low**	342	23.07	23.03	1.459	0.145
	High	841	20.91	23.12		
Shopping	**Low**	1516	12.57	12.23	1.512	0.131
	High	3831	11.96	15.67		
Leisure	**Low**	1850	40.27	56.97	2.455	**0.014***
	High	6411	36.74	44.86		

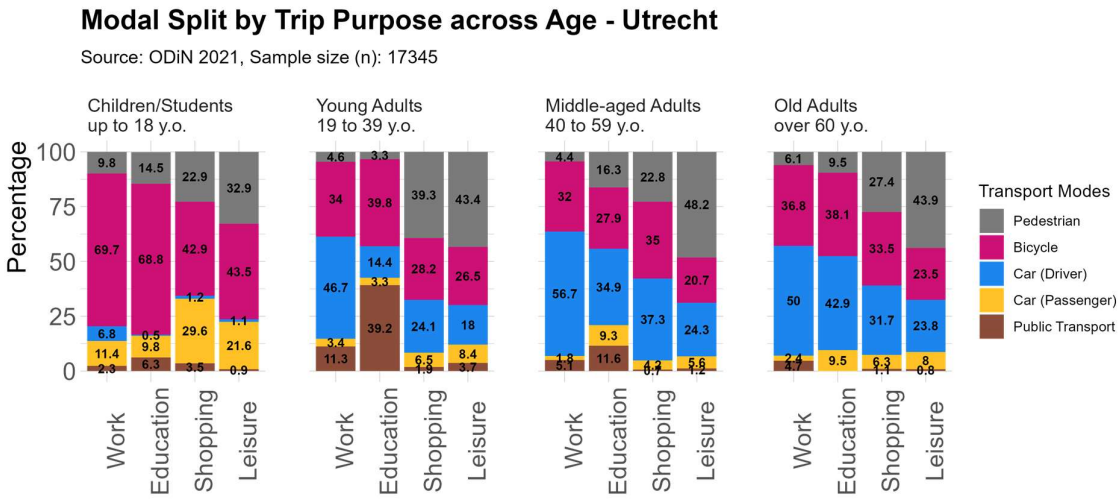
Significance level (*p*-value): *≤0.05 (5%)

B8: Trip distance statistics across income groups – Utrecht

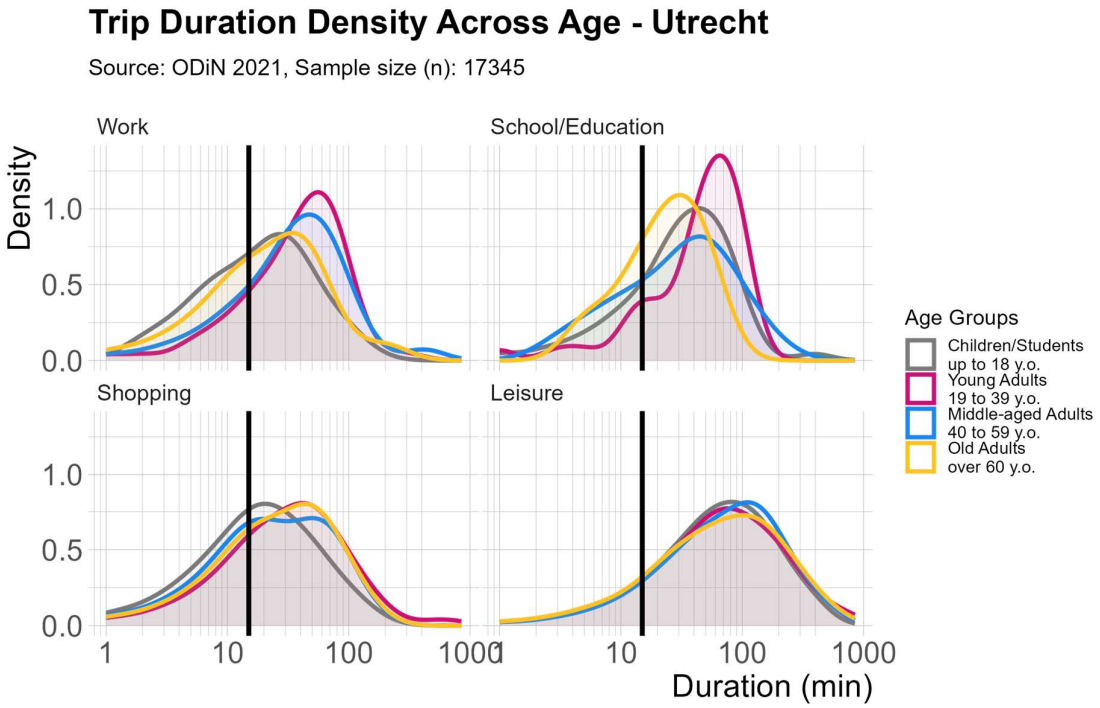
Trip Purpose	Income Group	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Low**	543	11.68	14.71	-6.042	**<0.05***
	High	2013	16.30	19.39		
Education	**Low**	342	6.79	11.56	-0.369	0.712
	High	841	7.08	12.95		
Shopping	**Low**	1516	3.02	5.89	-2.809	**<0.05***
	High	3831	3.57	7.68		
Leisure	**Low**	1850	8.57	17.16	-0.565	0.572
	High	6411	8.83	17.54		

Significance level (*p*-value): *≤0.05 (5%)

Age



B9: Modal split across age groups - Utrecht



B10: Trip duration density across age groups and trip purposes – Utrecht

B11: Trip duration statistics across age groups – Utrecht

Trip Purpose	Age Group	N	Mean (min)	SD	*Pr(>F)*
Work	**1**	132	16.89	14.34	**<0.001*** **
	2	1020	27.80	21.59	
	3	999	26.13	24.98	
	4	380	23.61	19.97	
Education	**1**	963	18.03	20.39	**<0.001*** **
	2	181	38.19	26.59	
	3	43	30.19	31.45	
	4	21	23.57	16.52	
Shopping	**1**	345	13.93	14.18	**0.018***
	2	1503	12.05	20.39	
	3	1747	11.45	11.30	
	4	1762	12.49	11.69	
Leisure	**1**	1512	30.13	42.99	**<0.001*** **
	2	1020	27.80	21.59	
	3	181	38.19	26.59	
	4	1503	12.05	20.39	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

B12: Trip distance statistics across age groups – Utrecht

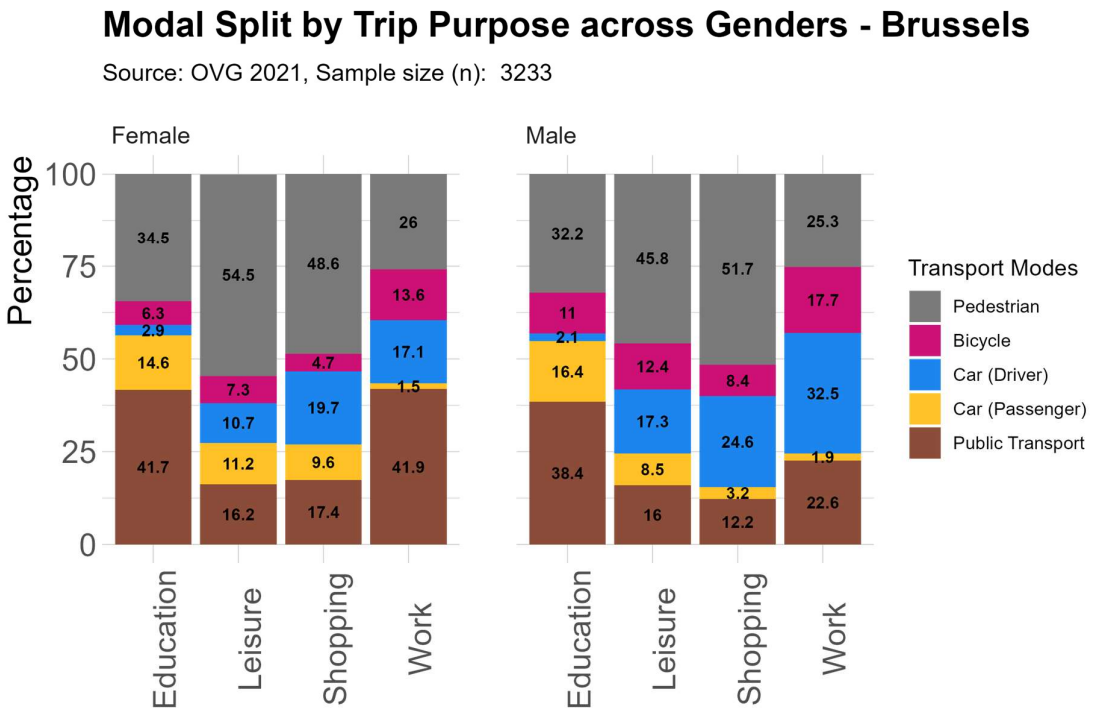
Trip Purpose	Age Group	N	Mean (km)	SD	*Pr(>F)*
Work	**1**	132	4.94	6.65	**<0.001*** **
	2	1020	16.66	19.61	
	3	999	16.09	18.44	
	4	380	12.44	16.57	
Education	**1**	963	4.47	7.57	**<0.001*** **
	2	181	19.14	22.09	
	3	43	11.23	16.40	
	4	21	8.97	9.22	
Shopping	**1**	345	4.54	10.11	**0.006****
	2	1503	3.09	6.78	
	3	1747	3.53	6.94	
	4	1762	3.28	7.04	
Leisure	**1**	1512	6.08	12.99	**<0.001*** **
	2	1020	9.10	18.26	
	3	181	9.53	19.25	
	4	1503	9.39	16.67	

Significance level (*p*-value): **≤0.01, ***≤0.001

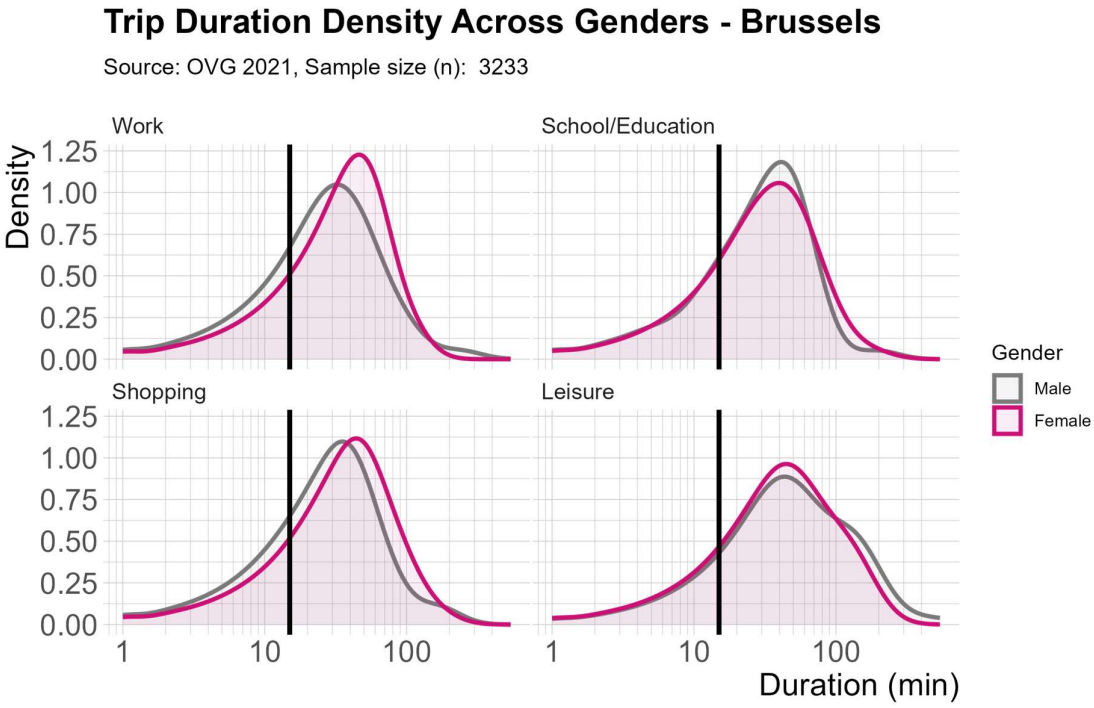
APPENDIX C

BRUSSELS

Gender



C1: Modal split across genders – Brussels



C2: Trip duration density across genders and trip purposes - Brussels

C3: Trip duration statistics across genders – Brussels

Trip Purpose	Gender	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Male**	265	24.25	21.46	-0.107	0.915
	Female	339	27.49	20.30		
Education	**Male**	146	24.34	22.67	-0.947	0.349
	Female	206	24.10	22.35		
Shopping	**Male**	501	14.33	15.79	0.144	0.886
	Female	685	16.09	17.37		
Leisure	**Male**	531	33.21	42.79	2.724	**0.007***
	Female	560	28.07	27.24		

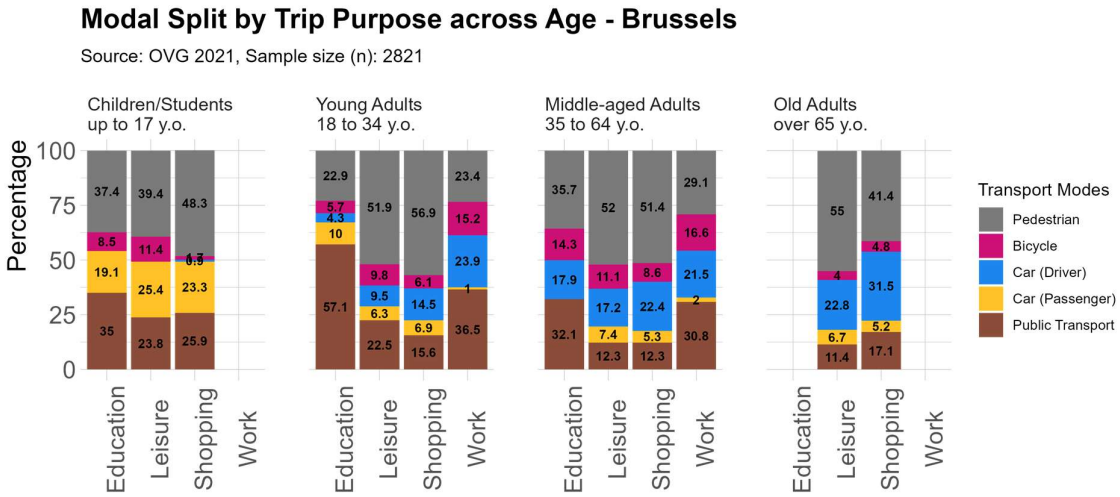
Significance level (*p*-value): *≤0.05 (5%)

C4: Trip distance statistics across income genders – Brussels

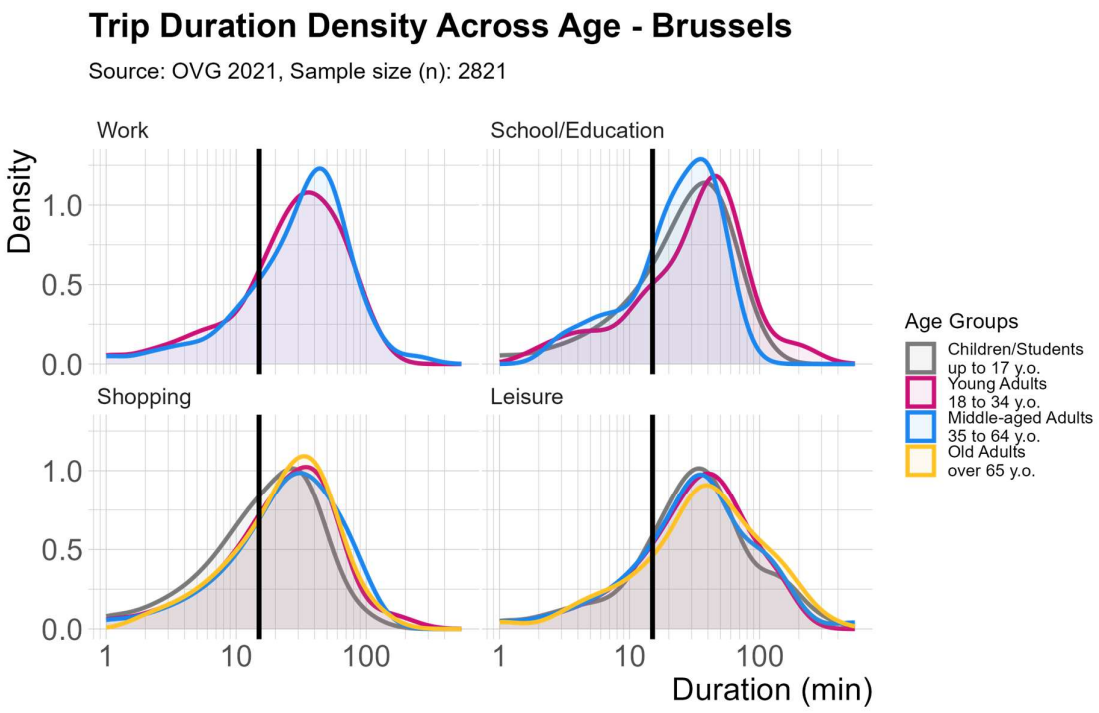
Trip Purpose	Gender	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Male**	265	16.15	34.86	0.402	0.688
	Female	339	14.29	20.18		
Education	**Male**	146	4.91	7.22	-0.419	0.677
	Female	206	5.97	11.24		
Shopping	**Male**	501	7.64	26.55	0.578	0.564
	Female	685	6.08	14.14		
Leisure	**Male**	531	15.65	30.00	2.319	**0.021***
	Female	560	9.45	20.89		

Significance level (*p*-value): *≤0.05 (5%)

Age



C5: Modal split across age groups - Brussels



C6: Trip duration density across age groups and trip purposes - Brussels

C7: Trip duration statistics across age groups – Brussels

Trip Purpose	Age Group	N	Mean (min)	SD	*Pr(>F)*
Work	**1**	Insufficient sample size for analysis			0.518
	2	197	27.95	16.24	
	3	302	25.00	15.48	
	4	Insufficient sample size for analysis			
Education	**1**	246	19.91	2.50	**<0.001*** **
	2	70	36.46	9.64	
	3	28	22.57	10.29	
	4	Insufficient sample size for analysis			
Shopping	**1**	116	16.29	10.04	0.156
	2	262	14.45	8.27	
	3	397	14.75	6.61	
	4	251	17.20	3.78	
Leisure	**1**	193	28.63	12.70	**0.02***
	2	285	28.78	19.86	
	3	325	29.33	9.81	
	4	149	39.21	12.18	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

C8: Trip distance statistics across age groups – Brussels

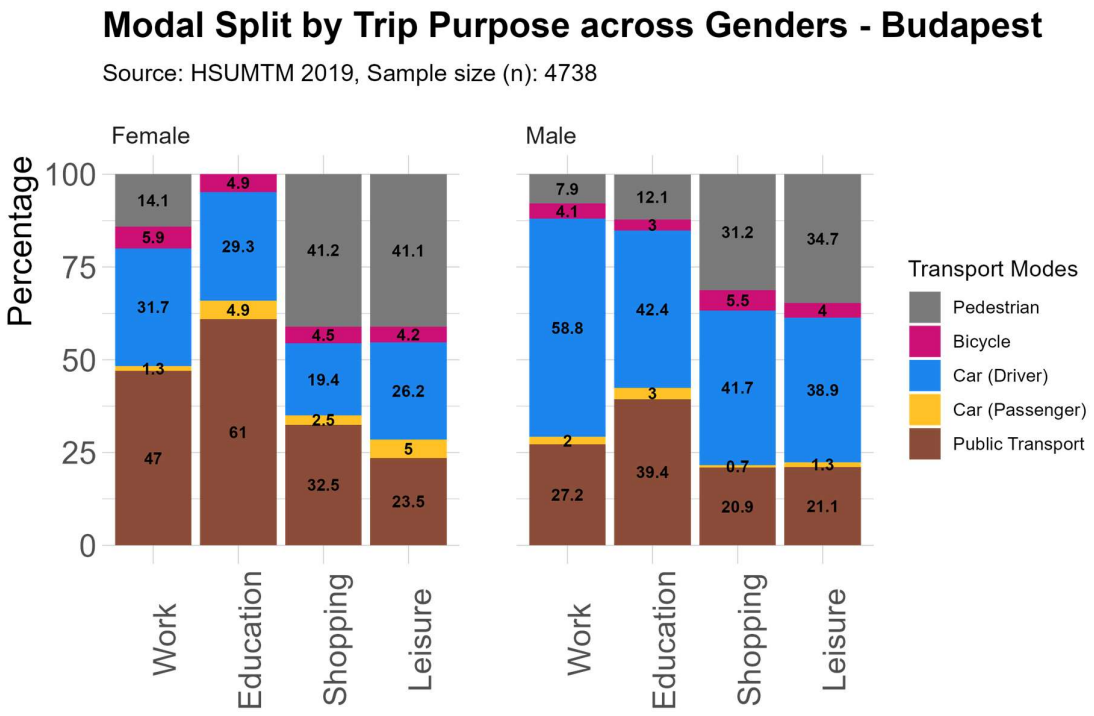
Trip Purpose	Age Group	N	Mean (km)	SD	*Pr(>F)*
Work	**1**	Insufficient sample size for analysis			0.995
	2	197	16.24	20.67	
	3	302	15.48	22.26	
	4	Insufficient sample size for analysis			
Education	**1**	246	2.50	16.30	**0.019***
	2	70	9.64	33.42	
	3	28	10.29	15.98	
	4	Insufficient sample size for analysis			
Shopping	**1**	116	10.04	13.95	0.211
	2	262	8.27	17.86	
	3	397	6.61	14.83	
	4	251	3.78	15.81	
Leisure	**1**	193	12.70	36.13	0.102
	2	285	19.86	27.43	
	3	325	9.81	41.12	
	4	149	12.18	41.17	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

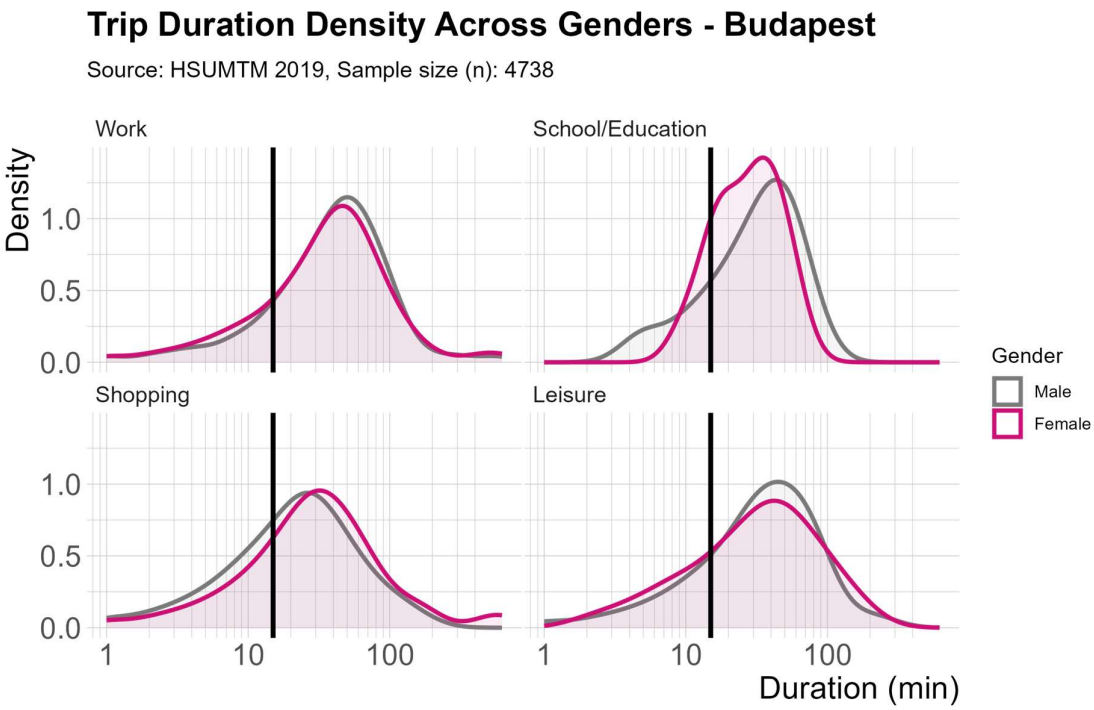
APPENDIX D

BUDAPEST

Gender



D1: Modal split across genders – Budapest



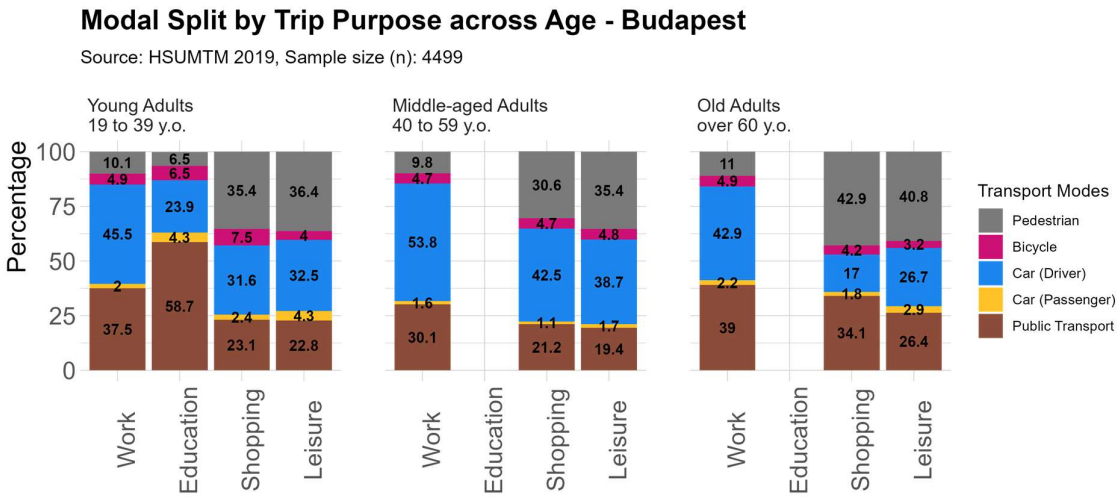
D2: Trip duration density across genders and trip purposes - Budapest

D3: Trip duration statistics across genders – Budapest

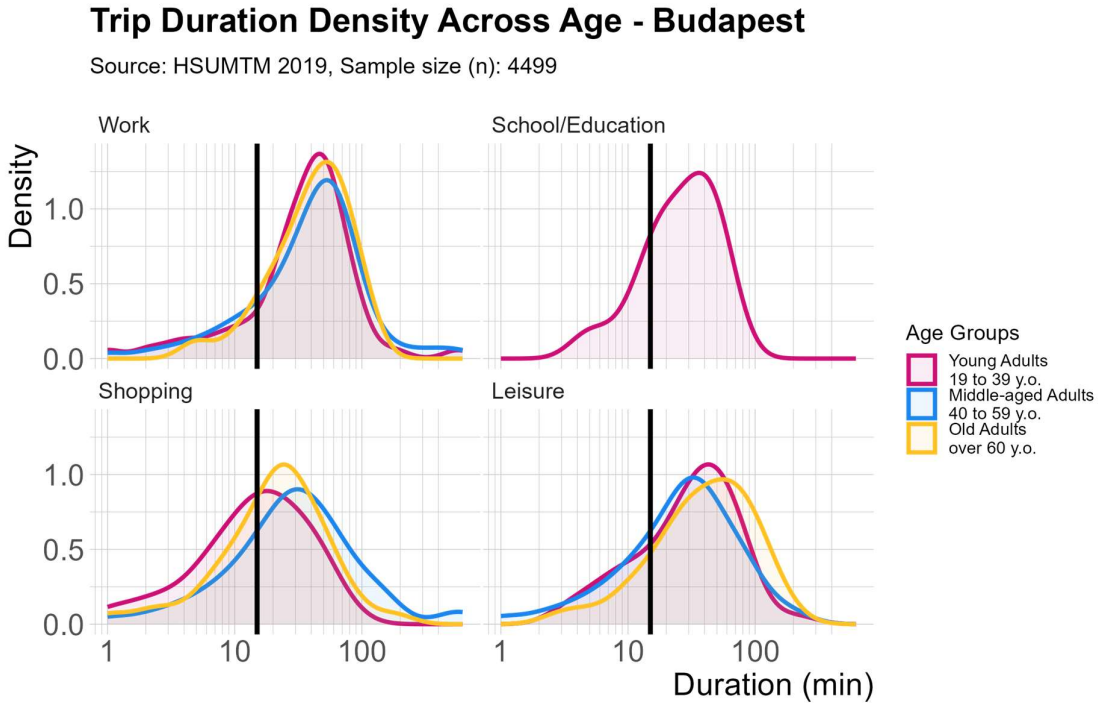
Trip Purpose	Gender	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Male**	1615	36.00	23.67	0.299	0.765
	Female	751	35.60	32.79		
Education	**Male**	33	33.94	17.53	1.249	0.217
	Female	41	29.34	13.19		
Shopping	**Male**	580	19.20	15.06	-1.468	0.143
	Female	692	21.33	34.38		
Leisure	**Male**	622	24.96	22.79	-0.437	0.663
	Female	404	25.60	23.00		

Significance level (*p*-value): *≤0.05 (5%)

Age



D4: Modal split across age groups - Budapest



D5: Trip duration density across age groups and trip purposes - Budapest

D6: Trip duration statistics across age groups – Budapest

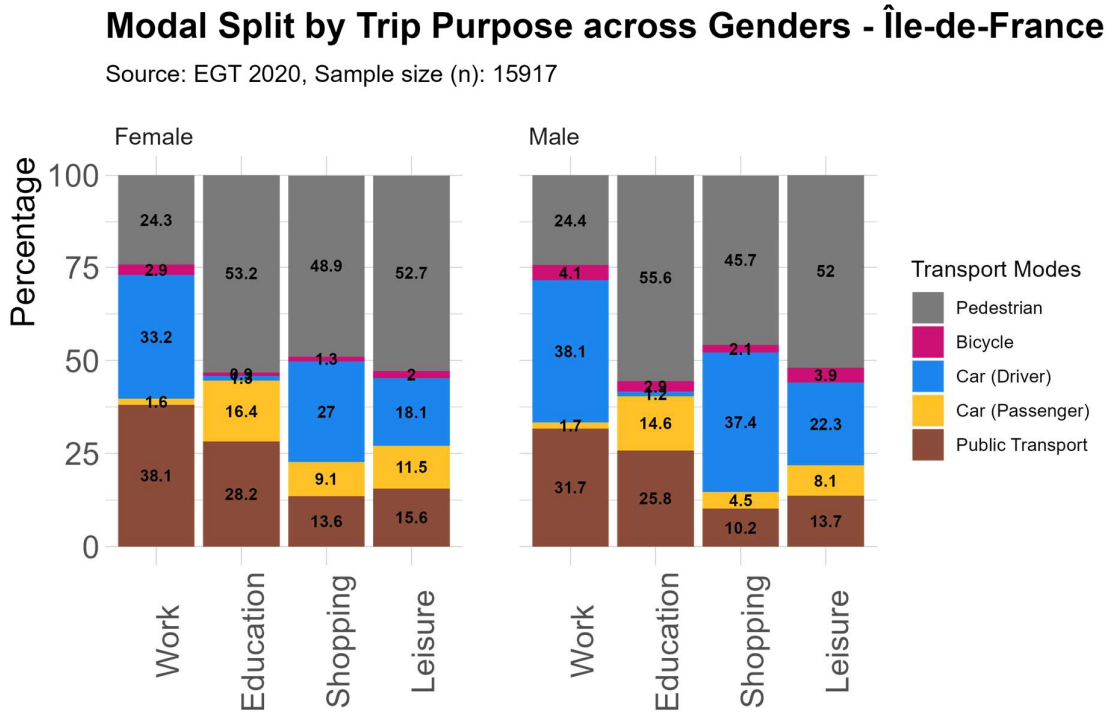
Trip Purpose	Age Group	N	Mean (min)	SD	*Pr(>F)*
Work	**1**	760	36.40	26.85	0.567
	2	1290	35.59	28.60	
	3	182	33.71	18.20	
Education	**1**	46	33.54	13.78	0.163
	2	Insufficient sample size for analysis			
	3				
Shopping	**1**	212	18.58	13.66	0.085
	2	471	23.55	40.98	
	3	546	18.53	13.98	
Leisure	**1**	302	25.49	21.34	0.089
	2	413	22.78	20.92	
	3	277	28.04	23.82	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

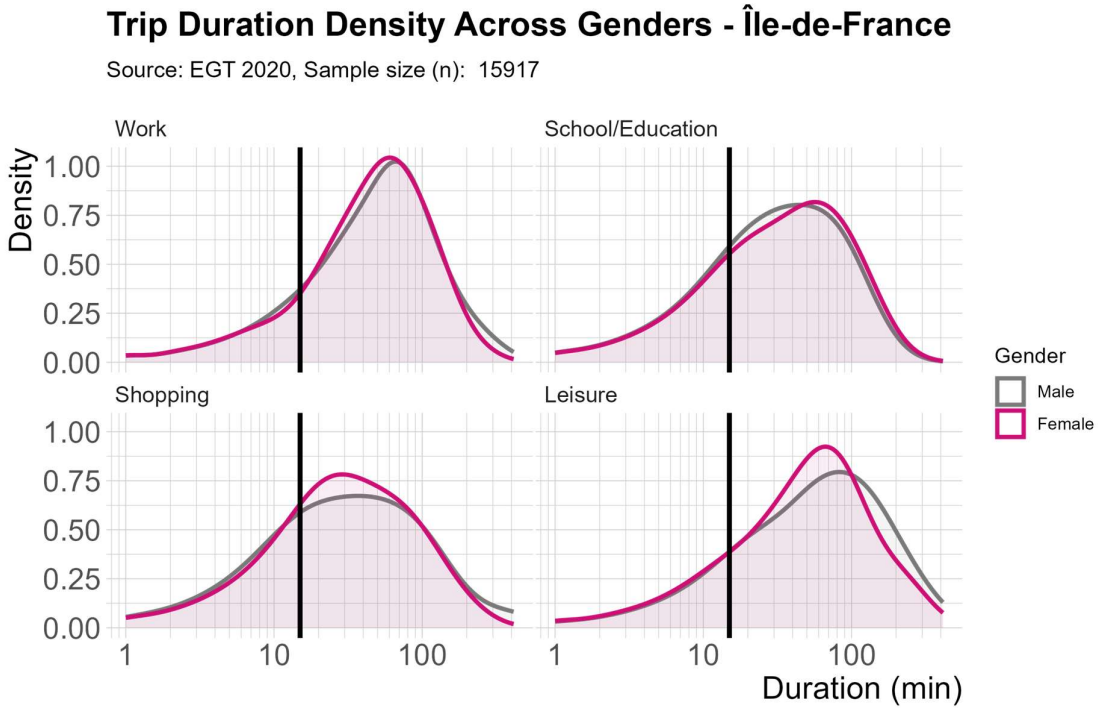
APPENDIX E

ÎLE -DE-FRANCE

Gender



E1: Modal split across genders – Île-de-France



E2: Trip duration density across genders and trip purposes - Île-de-France

E3: Trip duration statistics across genders – Île-de-France

Trip Purpose	Gender	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Male**	2087	34.6	29.3	1.006	0.315
	Female	2054	33.7	27.2		
Education	**Male**	1157	19.1	19.9	-1.286	0.199
	Female	1110	20.2	21.0		
Shopping	**Male**	1742	16.4	20.2	0.465	0.642
	Female	2367	16.1	15.8		
Leisure	**Male**	2556	23.7	28.4	1.626	0.104
	Female	2844	22.6	23.5		

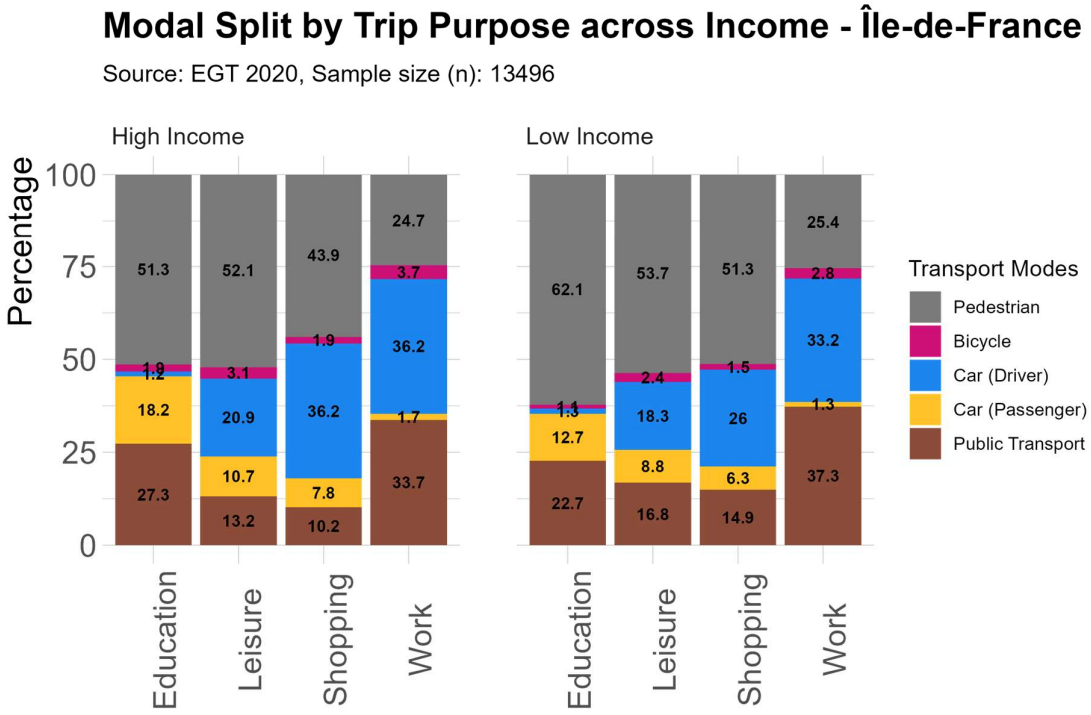
Significance level (*p*-value): *≤0.05 (5%)

E4: Trip distance statistics across genders – Île-de-France

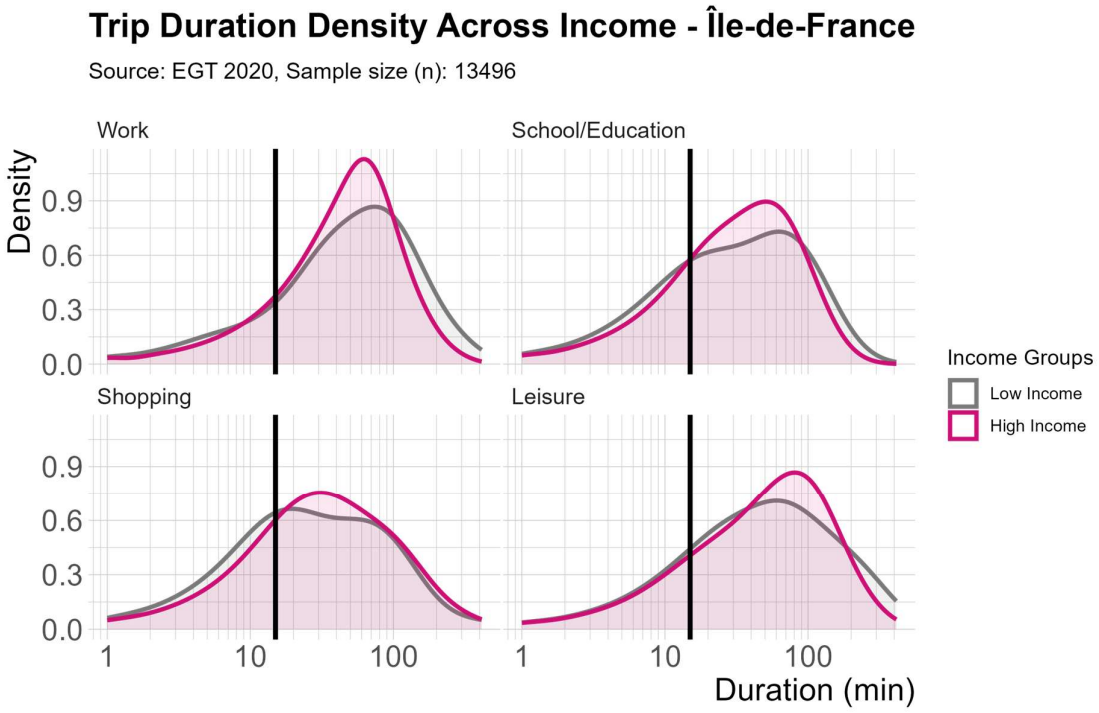
Trip Purpose	Gender	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Male**	2087	9.8	14.8	3.876	**0.0001***
	Female	2054	8.2	11.0		
Education	**Male**	1157	2.8	5.3	-1.196	0.232
	Female	1110	3.1	5.9		
Shopping	**Male**	1742	3.3	9.0	1.448	0.148
	Female	2367	2.9	7.2		
Leisure	**Male**	2556	4.5	16.2	2.410	**0.016***
	Female	2844	3.6	10.0		

Significance level (*p*-value): *≤0.05 (5%)

Income



E5: Modal split across income groups - Île-de-France



E6: Trip duration density across income groups and trip purposes - Île-de-France

E7: Trip duration statistics across income groups – Île-de-France

Trip Purpose	Income Group	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Low**	1048	34.2	31.1	0.200	0.841
	High	2480	34.0	27.3		
Education	**Low**	620	19.1	21.0	-0.332	0.740
	High	1288	19.4	19.8		
Shopping	**Low**	1446	16.4	18.5	0.459	0.647
	High	2013	16.1	18.1		
Leisure	**Low**	1686	25.5	29.5	4.726	**<0.05***
	High	2915	21.5	23.7		

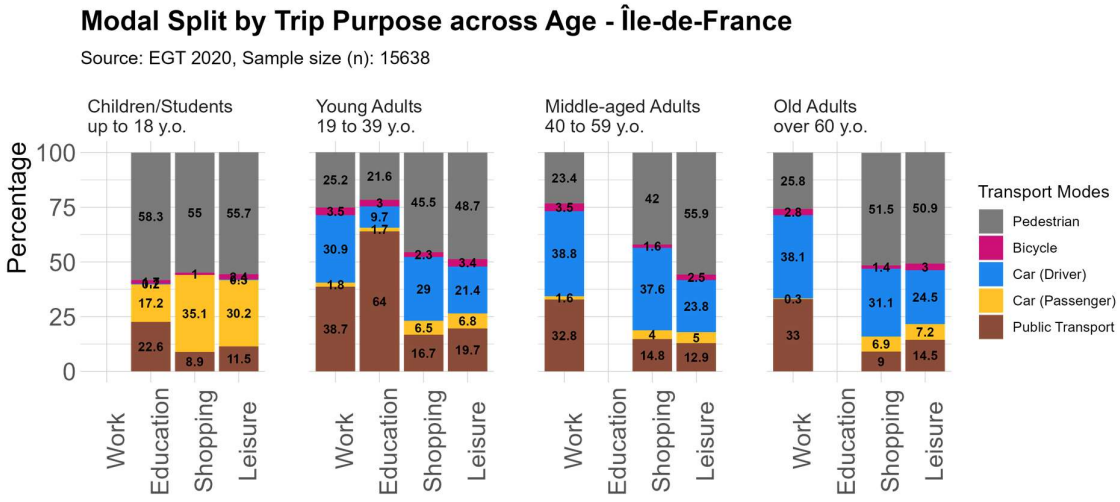
Significance level (*p*-value): *≤0.05 (5%)

E8: Trip distance statistics across income groups – Île-de-France

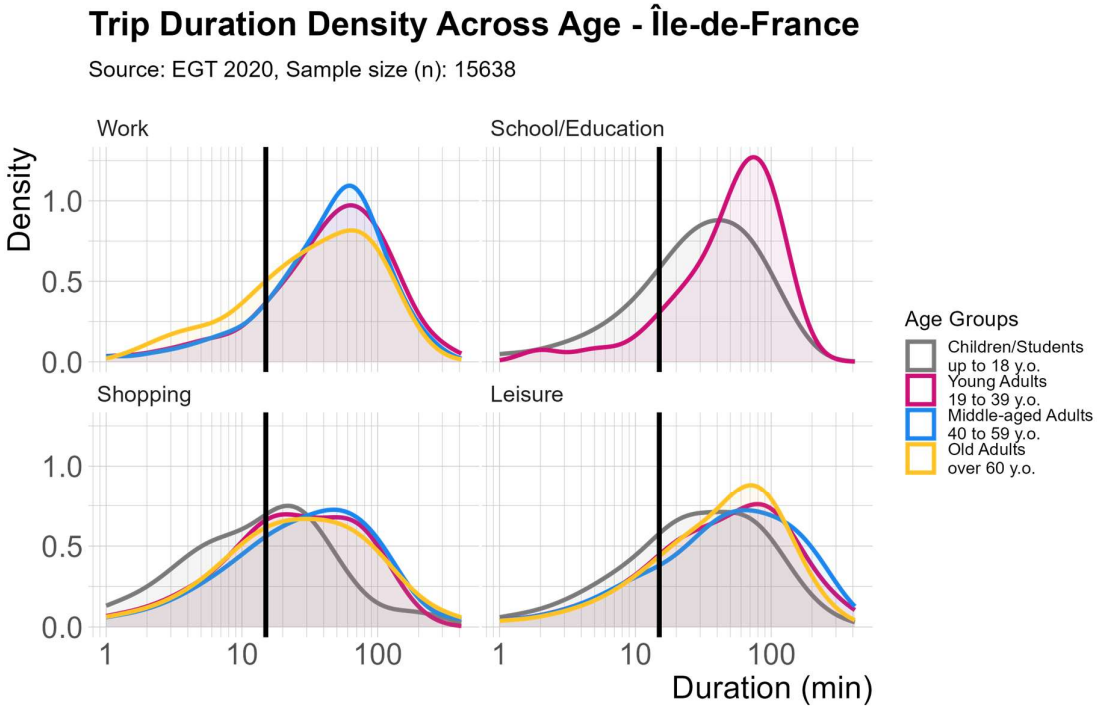
Trip Purpose	Income Group	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Low**	1048	34.2	31.1	-1.552	0.121
	High	2480	34.0	27.3		
Education	**Low**	620	19.1	21.0	-1.355	0.176
	High	1288	19.4	19.8		
Shopping	**Low**	1446	16.4	18.5	-3.979	**<0.05***
	High	2013	16.1	18.1		
Leisure	**Low**	1686	25.5	29.5	1.306	0.192
	High	2915	21.5	23.7		

Significance level (*p*-value): *≤0.05 (5%)

Age



E9: Modal split across age groups - Île-de-France



E10: Trip duration density across age groups and trip purposes - Île-de-France

E11: Trip duration statistics across age groups – Île-de-France

Trip Purpose	Age Group	N	Mean (min)	SD	*Pr(>F)*
Work	**1**	Insufficient sample size for analysis			0.267
	2	1387	34.8	29.4	
	3	2286	34.3	28.0	
	4	318	31.4	26.7	
Education	**1**	2021	16.2	15.4	**<0.001*** **
	2	236	48.5	32.0	
	3	Insufficient sample size for analysis			
	4	Insufficient sample size for analysis			
Shopping	**1**	191	12.5	15.8	**<0.001*** **
	2	659	17.0	17.4	
	3	1334	17.7	20.7	
	4	1874	15.3	15.8	
Leisure	**1**	792	17.5	18.2	**<0.001*** **
	2	1175	24.5	29.0	
	3	1462	21.6	27.5	
	4	1903	25.7	25.2	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

E12: Trip distance statistics across age groups – Île-de-France

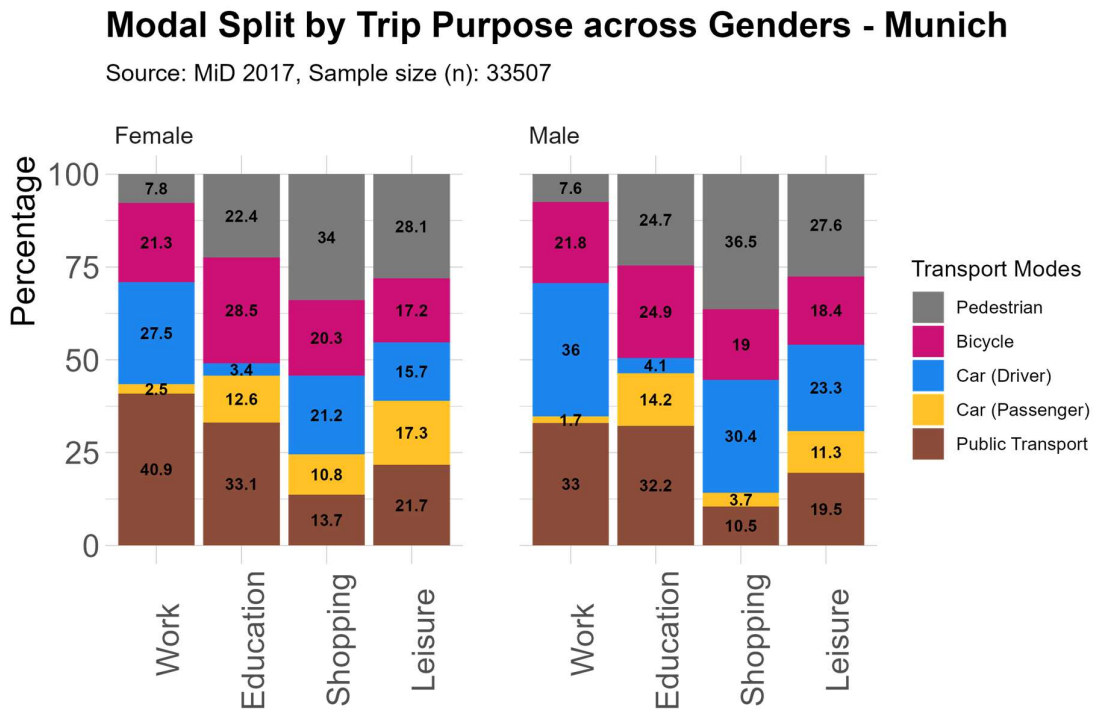
Trip Purpose	Age Group	N	Mean (km)	SD	*Pr(>F)*
Work	**1**	Insufficient sample size for analysis			**0.007****
	2	1387	9.0	11.7	
	3	2286	9.4	14.4	
	4	318	6.8	8.8	
Education	**1**	2021	2.0	3.5	**<0.001*** **
	2	236	11.2	10.9	
	3	Insufficient sample size for analysis			
	4	Insufficient sample size for analysis			
Shopping	**1**	191	2.6	15.1	**<0.001*** **
	2	659	3.3	5.8	
	3	1334	3.7	7.7	
	4	1874	2.5	7.9	
Leisure	**1**	792	2.4	8.2	**0.004****
	2	1175	4.5	16.3	
	3	1462	4.2	15.9	
	4	1903	4.2	10.6	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

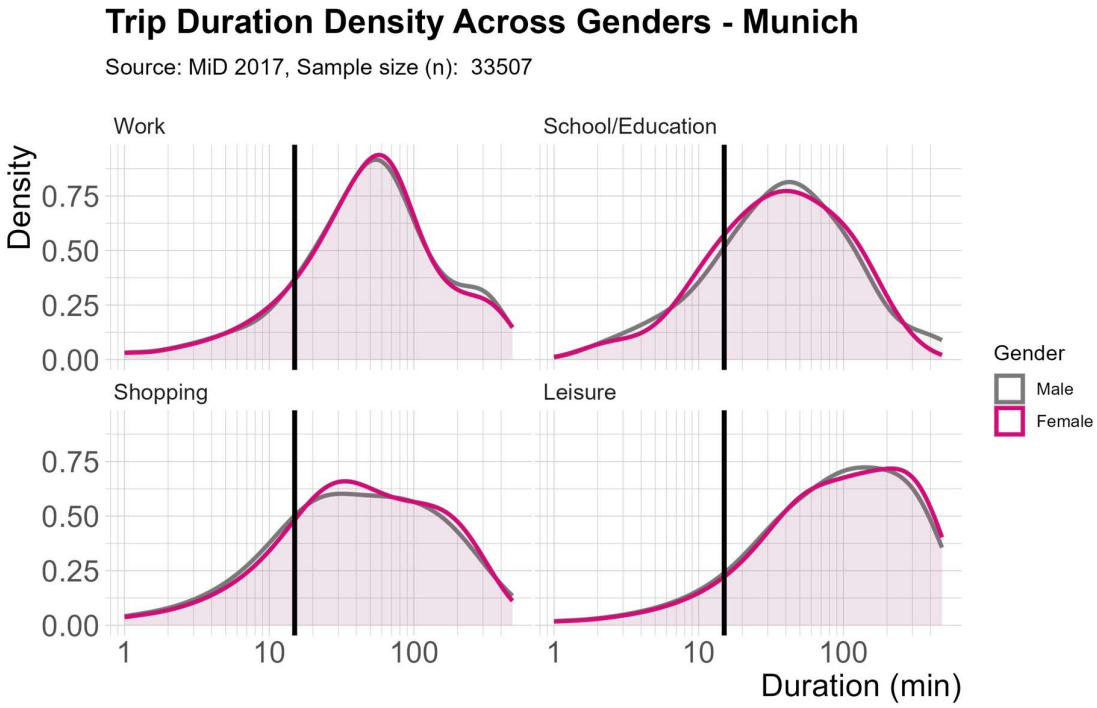
APPENDIX F

MUNICH

Gender



F1: Modal split across genders - Munich



F2: Trip duration density across genders and trip purposes - Munich

F3: Trip duration statistics across genders – Munich

Trip Purpose	Gender	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Male**	3595	32.4	27.5	1.740	0.082
	Female	3178	31.3	26.2		
Education	**Male**	1172	23.2	26.2	-0.692	0.489
	Female	1124	23.9	21.5		
Shopping	**Male**	4134	16.8	21.6	-1.294	0.196
	Female	4752	17.4	19.7		
Leisure	**Male**	7432	37.3	47.4	-0.955	0.340
	Female	8120	38.0	49.6		

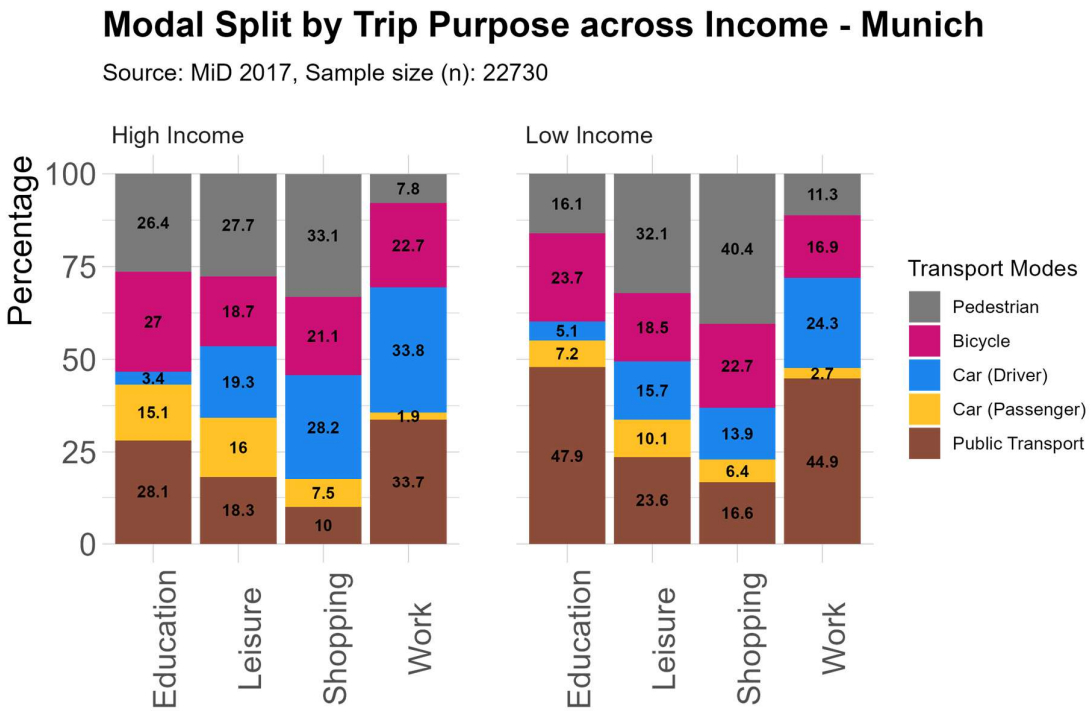
Significance level (*p*-value): *≤0.05 (5%)

F4: Trip distance statistics across genders – Munich

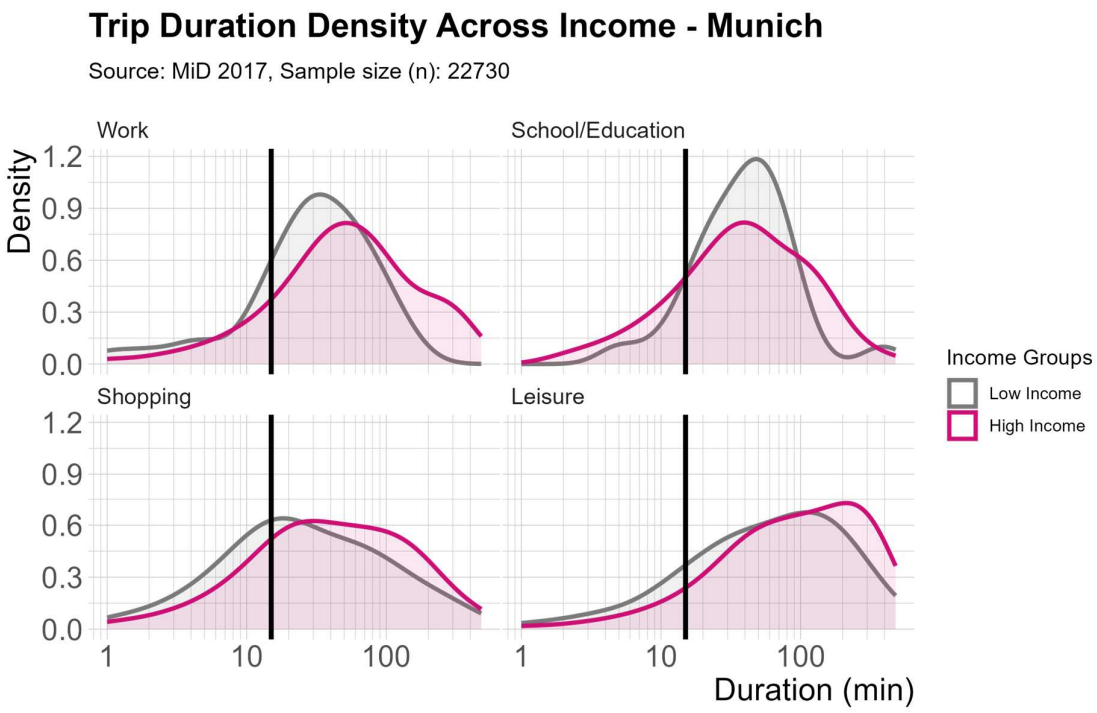
Trip Purpose	Gender	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Male**	3595	13.4	31.9	4.108	**<0.05***
	Female	3178	10.6	25.1		
Education	**Male**	1172	6.3	24.7	0.881	0.379
	Female	1124	5.6	15.1		
Shopping	**Male**	4134	4.0	17.4	1.927	0.054
	Female	4752	3.4	6.4		
Leisure	**Male**	7432	15.3	47.9	-1.213	0.225
	Female	8120	16.4	56.4		

Significance level (*p*-value): *≤0.05 (5%)

Income



F5: Modal split across income groups - Munich



F6: Trip duration density across income groups and trip purposes - Munich

F7: Trip duration statistics across age groups – Munich

Trip Purpose	Income Group	N	Mean (min)	SD	*t*-score	*p*-value
Work	**Low**	301	30.1	18.9	-1.100	0.272
	High	4751	31.4	25.9		
Education	**Low**	236	29.6	30.4	3.577	**<0.05***
	High	1686	22.2	23.1		
Shopping	**Low**	669	19.0	27.9	2.886	**<0.05***
	High	4733	15.8	18.8		
Leisure	**Low**	1038	37.9	51.2	0.858	0.391
	High	9316	36.5	47.8		

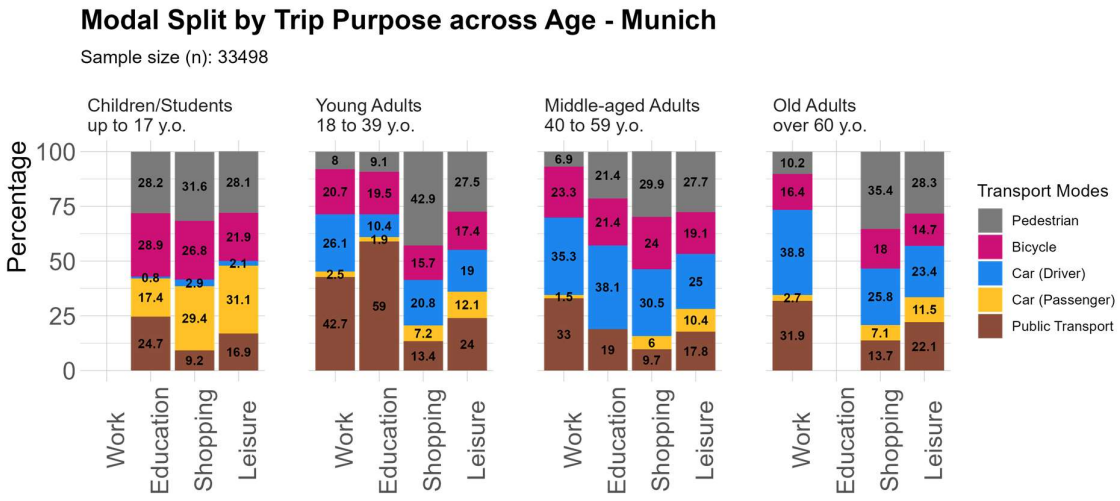
Significance level (*p*-value): *≤0.05 (5%)

F8: Trip distance statistics across age groups – Munich

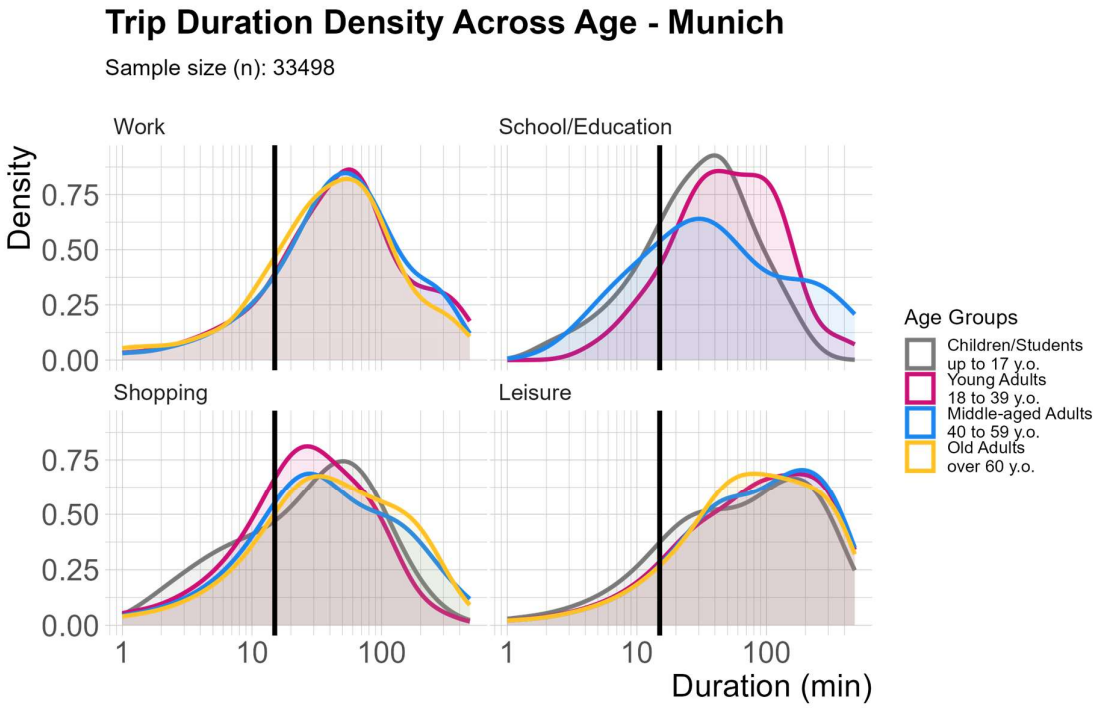
Trip Purpose	Income Group	N	Mean (km)	SD	*t*-score	*p*-value
Work	**Low**	301	9.2	13.0	-3.766	**<0.05***
	High	4751	12.5	31.7		
Education	**Low**	236	8.0	13.4	2.587	**<0.05***
	High	1686	5.4	20.2		
Shopping	**Low**	669	3.3	6.6	-1.644	0.100
	High	4733	3.8	15.9		
Leisure	**Low**	1038	9.8	27.3	-6.829	**<0.05***
	High	9316	16.8	56.2		

Significance level (*p*-value): *≤0.05 (5%)

Age



F9: Modal split across age groups - Munich



F10: Trip duration density across age groups and trip purposes – Munich

F10: Trip duration statistics across age groups – Munich

Trip Purpose	Age Group	N	Mean (min)	SD	*Pr(>F)*
Work	**1**	Insufficient sample size for analysis			0.413
	2	2666	32.5	28.1	
	3	3389	31.5	24.1	
	4	706	31.8	34.3	
Education	**1**	1714	19.1	16.2	**<0.001*** **
	2	527	35.6	31.1	
	3	42	45.0	74.0	
	4	Insufficient sample size for analysis			
Shopping	**1**	272	17.7	18.8	**<0.001*** **
	2	1970	15.8	16.4	
	3	2869	15.7	21.3	
	4	3777	18.8	22.1	
Leisure	**1**	2401	29.5	40.5	**<0.001*** **
	2	4200	37.1	49.3	
	3	4224	38.2	50.7	
	4	4741	41.9	49.1	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

F11: Trip distance statistics across age groups – Munich

Trip Purpose	Age Group	N	Mean (km)	SD	*Pr(>F)*
Work	**1**	Insufficient sample size for analysis			0.731
	2	2666	12.3	28.6	
	3	3389	12.0	29.0	
	4	706	11.5	30.0	
Education	**1**	1714	3.4	5.9	**<0.001*** **
	2	527	12.8	36.4	
	3	42	23.0	64.1	
	4	Insufficient sample size for analysis			
Shopping	**1**	272	4.0	6.1	0.151
	2	1970	3.6	8.1	
	3	2869	4.1	19.1	
	4	3777	3.4	8.3	
Leisure	**1**	2401	12.2	45.5	**<0.001*** **
	2	4200	17.5	55.5	
	3	4224	17.3	54.7	
	4	4741	15.0	50.9	

Significance level (*p*-value): *≤0.05, **≤0.01, ***≤0.001

APPENDIX G

G1: Gender-Based Comparison of Travel Time (min) at the City Level

Trip Purpose	Vienna		Utrecht		Brussels		Budapest		Île-de-France		Munich	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Pedestrian												
Work	12.37	11.44	12.8	9.4	10.2	11.8	11.4	12.2	10.1	10.0	16.1	17.8
Education	11.07	10.28	8.8	9.1	12.1	10.6	-	-	9.7	10.3	13.2	15.1
Shopping	13.21	12.75	10.1	10.2	9.7	11.4	12.0	11.7	9.5	9.9	13.8	14.7
Leisure	34.06	35.32	41.3	42.1	32.9	27.1	12.5	13.0	15.8	15.3	35.1	35.2
Bicycle												
Work	19.10	17.60	20.0	20.1	19.6	17.5	23.7	32.3	26.2	25.3	23.7	21.6
Education	-	-	18.5	16.9	-	-	-	-	19.8	-	15.9	16.2
Shopping	12.12	10.42	11.0	10.6	10.8	9.4	18.8	20.3	15.4	17.7	13.2	13.5
Leisure	43.83	29.00	36.7	34.8	25.6	29.9	19.5	-	31.9	37.6	29.7	26.0
Car (as Driver)												
Work	26.45	23.22	27.5	27.0	28.3	26.8	36.1	35.0	33.1	30.0	29.7	28.6
Education	23.15	-	35.0	28.4	-	-	-	-	-	-	46.1	42.5
Shopping	17.12	14.77	12.8	13.1	18.1	15.6	20.6	31.4	18.0	16.8	18.2	16.0
Leisure	31.09	25.57	31.3	26.3	35.0	24.1	32.4	32.4	26.8	23.0	39.0	36.7
Car (as Passenger)												
Work	-	21.57	29.3	24.5	-	-	40.0	-	20.3	18.4	38.7	38.1
Education	17.60	12.41	17.1	18.3	21.3	15.5	-	-	13.7	11.3	16.4	17.3
Shopping	19.61	16.59	16.2	16.9	-	15.1	-	-	16.6	16.5	19.5	20.5
Leisure	24.08	31.56	34.2	35.1	34.3	21.7	-	33.2	20.0	23.1	36.6	41.3
Public Transport												
Work	38.08	36.53	60.6	51.5	37.6	40.4	44.4	43.5	57.1	53.4	44.5	40.3
Education	31.43	31.94	53.1	58.2	40.3	38.5	-	33.5	41.9	43.6	36.5	37.0
Shopping	26.17	25.39	-	49.4	27.0	32.0	27.4	28.2	41.0	36.4	29.0	29.5
Leisure	34.42	34.49	69.9	73.9	37.5	37.5	32.7	39.3	48.8	44.1	45.9	49.6

G2: Gender-Based Comparison of Travel Distance (km) at the City Level

Trip Purpose	Vienna		Utrecht		Brussels		Budapest		Île-de-France		Munich	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Walk												
Work	1.00	0.88	1.1	0.8	1.5	1.4			0.6	0.6	1.6	1.4
Education	0.95	0.68	0.9	0.7	1.2	1.2			0.6	0.6	0.8	1.0
Shopping	0.88	0.78	0.7	0.7	1.5	1.6			0.5	0.5	0.8	0.8
Leisure	2.31	2.19	3.0	2.9	3.5	2.5			0.6	0.6	2.1	2.0
Bicycle												
Work	4.09	3.31	4.7	4.6	6.4	6.6			5.2	3.8	5.7	4.5
Education	-	-	3.6	3.2	-	-			3.2	-	2.6	2.5
Shopping	1.96	1.39	2.0	1.8	2.4	2.8			2.2	2.7	2.1	2.0
Leisure	9.78	4.50	6.5	5.3	10.6	8.9			5.0	13.1	5.4	4.2
Car (as Driver)												
Work	13.07	9.98	23.5	20.5	22.0	22.1			11.9	9.4	16.7	14.9
Education	9.51	-	26.7	18.2	-	-			-	-	36.4	31.1
Shopping	7.87	5.80	6.0	5.7	13.0	7.4			5.2	4.6	7.4	5.3
Leisure	22.28	16.28	18.4	16.1	29.0	15.0			8.8	6.7	29.4	24.2
Car (as Passenger)												
Work	-	13.49	18.1	14.9	-	-			5.4	5.9	16.6	22.9
Education	6.62	3.94	7.7	8.3	5.1	2.1			2.7	2.1	7.1	5.2
Shopping	8.01	8.23	8.6	8.3	-	12.4			3.1	4.6	7.5	7.6
Leisure	13.74	21.56	18.4	22.0	37.1	24.3			6.4	6.4	27.8	32.4
Public Transport												
Work	11.66	9.56	34.9	25.5	7.7	11.6			15.1	12.5	17.5	11.8
Education	8.05	7.99	30.0	25.8	17.0	7.6			7.4	8.0	9.3	8.8
Shopping	6.15	5.94	-	15.9	2.7	4.7			9.0	7.0	7.4	5.9
Leisure	12.06	11.28	38.2	37.3	14.1	2.3			10.9	6.8	19.5	26.1

G3: Age-Based Comparison of Travel Time (min) at the City Level

Trip Purpose	Vienna*				Utrecht*				Brussels**				Budapest*				Île-de-France*				Munich***			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Walk																								
Work	-	10.8	12.3	-	-	10.6	11.5	16.0	-	12.7	10.5	-		9.6	13.1	11.5	-	10.0	10.3	9.7	-	15.9	16.0	23.0
Education	10.1	12.4	-	-	8.8	-	-	-	11.4	-	-	-		-	-	-	10.0	9.9	-	-	14.0	15.0	-	-
Shopping	14.0	10.0	10.9	15.9	10.4	9.2	9.2	12.1	10.7	8.3	10.2	15.6	-	10.0	11.4	12.8	8.3	8.5	8.6	11.0	15.1	12.4	12.4	16.7
Leisure	24.6	28.7	37.3	40.2	37.8	42.4	39.6	45.9	24.3	24.0	31.0	40.7		10.1	11.1	17.6	14.2	14.6	13.6	18.6	25.5	32.5	33.0	44.1
Bicycle																								
Work	-	19.3	18.2	-	15.1	19.2	22.6	19.1	-	14.4	19.2			27.8	27.1	-	-	26.1	26.3	-	-	22.1	23.7	19.0
Education	-	-	-	-	17.1	20.7	-	-	9.1	-	-	-	-	-	-	-	17.7	-	-	-	14.7	21.0	-	-
Shopping	-	-	11.8	-	10.8	10.7	10.2	11.3	-	-	9.7			-	26.6	15.3	-	-	15.2	17.1	13.6	12.5	11.9	15.2
Leisure	-	29.9	42.3	-	24.7	30.2	41.9	50.4	39.4	20.3	23.7			-	19.0	-	-	37.3	30.4	40.6	19.3	23.4	32.5	33.5
Car (as Driver)																								
Work	-	28.6	24.2	24.0	-	28.4	27.3	24.6		30.0	28.3	-		38.1	34.8	33.5	-	32.9	31.4	29.1	-	30.7	29.0	27.0
Education	-	-	-	-	-	34.1	-	-		-	-	-		-	-	-	-	30.9	-	-	-	41.9	-	-
Shopping	-	14.9	17.4	15.3	-	13.2	12.8	13.0	-	19.5	16.7	13.3	-	20.7	27.4	21.1	-	17.2	19.6	15.8	-	17.1	17.6	16.8
Leisure	-	22.3	32.8	31.0	-	28.3	27.3	31.1		41.1	22.0	35.7		36.0	29.5	31.5	-	24.2	24.7	25.0	40.3	38.0	39.9	36.2
Car (as Passenger)																								
Work	-	-	20.2	-	-	30.4	-	-	-		-			-	32.6	-	-	19.0	19.1	-	-	39.8	31.4	-
Education	14.6	-	-	-	16.7	-	-	-	-	-	-	-	-	-	-	-	12.3	-	-	-	15.7	-	-	-
Shopping	-	-	17.3	17.4	16.7	17.3	17.5	15.1	16.7		23.6			-	-	-	12.0	20.7	17.9	17.0	19.9	20.7	19.0	20.9
Leisure	23.3	28.2	31.0	34.4	25.7	39.3	46.1	39.0	15.5		25.5			-	-	-	16.2	22.5	22.2	30.9	33.8	46.7	40.1	40.3
Public Transport																								
Work	44.7	28.5	22.0	32.7	-	57.5	50.9	53.7	-	41.5	39.6	-		42.3	45.9	40.9	-	54.0	56.6	51.3	-	41.2	43.0	45.0
Education	36.1	35.3	24.8	31.1	50.7	60.2	-	-	33.4	47.8	-	-		38.2	-	-	35.0	65.5	-	-	32.4	42.1	-	-
Shopping	37.6	41.7	26.7	35.7	-	59.5	-	-	27.8	32.7	29.8	30.3	-	29.8	33.0	25.0	41.1	38.0	38.9	36.8	26.8	26.3	27.4	31.9
Leisure	39.7	-	26.0	37.7	-	63.8	70.4	-	35.4	35.7	40.1	-		32.7	31.7	42.4	36.3	47.9	48.2	46.5	40.2	46.6	49.2	51.4

		Age Groups
*	1	Up to 18 years old
	2	19 to 39 years old
	3	40 to 59 years old
	4	Over 60 years old
**	1	Up to 17 years old
	2	18 to 34 years old
	3	35 to 64 years old
	4	Over 65 years old
***	1	Up to 17 years old
	2	18 to 39 years old
	3	40 to 59 years old
	4	Over 60 years old

G4: Age-Based Comparison of Travel Distance (km) at the City Level

Trip Purpose	Vienna				Utrecht				Brussels				Budapest				Île-de-France				Munich			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Walk																								
Work	-	0.9	0.9	-	-	0.7	1.3	1.2	-	1.3	1.5	-					-	0.6	0.6	0.7	-	1.6	1.5	1.2
Education	0.7	1.1	-	-	0.8	-	-	-	1.1	-	-	-					0.6	0.4	-	-	0.8	1.2	-	-
Shopping	0.9	0.7	0.8	0.9	0.8	0.7	0.7	0.9	1.3	1.8	1.3	1.9					0.5	0.5	0.5	0.5	0.9	0.7	0.7	0.9
Leisure	1.6	2.0	2.5	2.4	2.2	3.1	3.1	3.0	2.8	2.6	3.2	3.4					0.6	0.5	0.5	0.7	1.2	2.1	2.1	2.4
Bicycle																								
Work	-	3.9	3.8	-	3.0	4.4	5.3	4.7	-	5.8	6.4	-					-	5.2	4.6	-	-	5.0	5.4	3.7
Education	-	-	-	-	3.2	4.3	-	-	3.0	-	-	-					2.6	-	-	-	2.1	4.3	-	-
Shopping	-	-	1.8	-	1.8	1.9	1.8	2.0	-	-	2.6	-					-	-	2.2	2.2	2.5	2.1	2.0	2.1
Leisure	-	5.4	10.0	-	3.2	4.8	7.4	9.3	14.9	6.3	8.1	-					-	6.7	11.3	9.4	2.6	4.4	6.0	5.6
Car (as Driver)																								
Work	-	14.8	11.2	9.0	-	23.5	22.4	18.0		21.6	24.4	-					-	11.7	10.7	8.0	-	17.6	15.7	13.3
Education	-	-	-	-	-	28.0	-	-		-	-	-					-	11.0	-	-	-	36.3	-	-
Shopping	-	7.4	7.7	6.1	-	5.8	6.0	5.9	-	14.7	7.7	5.2					-	4.9	5.7	4.3	-	6.7	7.4	5.4
Leisure	-	12.1	23.1	23.9	-	18.2	17.7	16.0		40.6	16.6	22.6					-	7.5	7.9	7.8	19.1	28.9	29.3	24.2
Car (as Passenger)																								
Work	-	-	11.6	-	-	17.2	-	-									-	6.3	4.9		-	26.2	11.8	-
Education	4.9	-	-	-	6.2	-	-	-	4.0								2.3	-			4.6	-	-	-
Shopping	-	-	9.3	7.2	8.4	9.6	8.8	6.4	18.1	-	23.2	-					2.8	4.3	6.5	4.0	7.4	9.8	7.4	6.6
Leisure	13.5	18.7	23.7	20.8	15.3	23.9	30.0	21.0	18.7		28.0						4.6	5.8	8.2	8.8	26.7	40.3	32.0	26.0
Public Transport																								
Work	10.9	7.2	5.8	8.6	-	31.8	27.5	22.1	-	8.1	12.3	-					-	12.9	14.7	10.5	-	13.8	15.1	15.5
Education	10.6	8.5	6.0	7.8	22.6	31.2	-	-	3.0	11.3	-	-					5.1	15.1	-	-	6.9	11.9	-	-
Shopping	10.2	12.8	6.3	13.3	-	14.6	-	-	4.8	4.3	4.5	2.3					15.5	7.7	7.5	7.1	7.0	6.2	7.4	6.1
Leisure	10.4	-	5.8	15.5	-	32.1	45.1	-	27.0	13.5	6.4	-					5.8	10.3	10.5	6.9	15.5	24.1	27.6	22.0

		Age Groups
*	1	Up to 18 years old
	2	19 to 39 years old
	3	40 to 59 years old
	4	Over 60 years old
**	1	Up to 17 years old
	2	18 to 34 years old
	3	35 to 64 years old
	4	Over 65 years old
***	1	Up to 17 years old
	2	18 to 39 years old
	3	40 to 59 years old
	4	Over 60 years old

G5: Income-Based Comparison of Travel Time (min) at the City Level

Trip Purpose	Vienna		Utrecht		Brussels		Budapest		Île-de-France		Munich	
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Walk												
Work	-	12.0	14.1	10.3					10.4	9.8	17.6	16.1
Education	-	9.5	9.2	8.4					10.1	10.0	11.2	14.2
Shopping	10.2	12.7	10.9	9.9					10.4	9.3	12.9	13.3
Leisure	39.2	32.1	42.4	41.2					18.0	14.2	39.9	32.6
Bicycle												
Work	-	19.1	20.6	19.9					24.3	26.7	19.8	22.9
Education	-	-	18.3	17.5					-	18.7	17.3	15.6
Shopping	-	10.9	11.1	10.5					14.9	15.6	16.1	12.0
Leisure	-	33.9	40.6	34.2					33.6	30.6	28.6	26.6
Car (as Driver)												
Work	31.5	25.0	23.8	27.9					27.6	33.0	26.4	29.7
Education	-	22.7	-	31.8					-	-	-	46.4
Shopping	-	15.6	12.8	13.0					17.2	17.4	20.5	16.5
Leisure	-	31.9	32.1	28.6					26.8	23.8	34.5	38.1
Car (as Passenger)												
Work	-	27.5	31.4	24.2					-	20.7	-	31.8
Education	-	13.9	-	17.4					12.1	12.5	-	15.7
Shopping	-	15.0	18.1	16.2					18.0	15.8	24.9	19.1
Leisure	-	29.3	36.2	34.2					26.5	19.7	42.6	39.3
Public Transport												
Work	39.0	35.8	53.6	56.2					57.6	54.1	38.8	42.2
Education	35.9	31.7	55.1	56.9					45.6	41.6	40.0	36.6
Shopping	23.1	25.8	38.9	61.2					35.1	40.8	34.0	27.4
Leisure	27.3	32.9	69.5	73.5					46.3	46.2	42.7	48.2

G6: Income-Based Comparison of Travel Distance (km) at the City Level

Trip Purpose	Vienna		Utrecht		Brussels		Budapest		Île-de-France		Munich	
	Low	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Walk												
Work	-	0.9	1.3	0.8					0.6	0.5	2.0	1.4
Education	-	0.7	0.7	0.8					0.7	0.5	0.8	0.9
Shopping	0.7	0.8	0.8	0.7					0.5	0.5	0.7	0.7
Leisure	2.3	2.1	2.8	3.0					0.6	0.6	1.9	2.0
Bicycle												
Work	-	4.1	4.3	4.8					4.7	4.7	4.4	5.2
Education	-	-	3.4	3.4					-	3.0	2.7	2.3
Shopping	-	1.7	1.8	1.9					2.2	1.9	2.3	1.9
Leisure	-	7.7	6.1	5.9					5.6	7.3	3.9	4.6
Car (as Driver)												
Work	14.2	12.0	16.8	23.0					9.2	11.5	12.8	16.7
Education	-	9.5	-	24.5					-	-	-	40.0
Shopping	-	6.8	5.4	6.1					4.2	5.4	6.5	6.9
Leisure	-	23.5	17.7	17.4					9.2	7.4	16.6	28.9
Car (as Passenger)												
Work	-	22.5	20.3	14.2					-	5.5	-	17.9
Education	-	4.2	-	8.0					2.1	2.5	-	4.6
Shopping	-	6.3	7.7	8.6					4.0	4.5	5.9	8.2
Leisure	-	18.6	18.6	21.2					9.8	5.1	24.0	32.2
Public Transport												
Work	10.6	9.7	25.6	32.6					13.3	13.5	10.8	15.4
Education	8.5	8.0	22.6	29.8					7.5	7.9	10.4	8.7
Shopping	4.3	6.1	13.9	19.3					5.8	9.9	7.1	6.4
Leisure	6.4	10.9	34.2	41.4					8.4	9.4	14.7	25.7

APPENDIX H

PLEASE FILL IN FOR EACH SURVEY DATASET AVAILABLE

Questionnaire regarding the attributes of the available mobility survey datasets

A. General information about the survey

1. **Name of the survey (National language/English):** *Click here to enter text.*
2. **Short description of the purpose *and* the method of the survey:** *Click here to enter text.*
3. **Year:** *Click here to enter text.*
4. **Number of reported days per respondent:** *Click here to enter text.*
5. **Which days (weekdays, weekends etc.) are reported in the survey?:** *Click here to enter text.*
6. **Which was the period (i.e. season, month etc.) the survey was conducted?:** *Click here to enter text.*
7. **Net sample size:** *Click here to enter text.*
8. **Survey area (country, city, municipality etc.):** *Click here to enter text.*
9. **How the survey defines the reported trip?:** *Click here to enter text.*
10. **Does the survey focus on a specific population group (migrants, gender, students etc.)?**
    - ☐ Yes (If yes, please explain in the following field)
      Click here to enter text.
    - ☐ No
11. **Are available the question forms (or any other related documents) of the survey?**
    - ☐ Yes (If yes, please provide us with the document(s))
    - ☐ No
12. **Please write below the citation of the survey for future use in the DREAMS project:**
    Click here to enter text.

B. Dataset information

13. **Is the dataset publicly available?**
    - ☐ Yes (If yes, please indicate below where it is deposited)
      Click here to enter text.
    - ☐ No (If no, please let us know the procedure to obtain access to the dataset)
      Click here to enter text.
14. **Are there any utilization rights or regulations on the accessibility of the dataset?**
    - ☐ Yes (If yes, please explain in the following field)
      Click here to enter text.
    - ☐ No
15. **Please select the format type(s) of the dataset:**
    - ☐ Excel File (XLS)
    - ☐ CSV File
    - ☐ SPSS File

- ☐ R-Data File
- ☐ Other: *Click here to enter text.*

16. **Language of the dataset:** *Click here to enter text.*
17. **Is the dataset encoded (i.e. categories or answers are converted into numerical/alphabetical code)?**
    - ☐ Yes (If yes, please provide us with an explanatory document)
    - ☐ No

C. Information about the attributes of households and people

18. **Please select (or add) the household attributes included in the dataset:**
    - ☐ Living location (*Indicate here the aggregation level (postal code, district etc.)*)
    - ☐ Household size
    - ☐ Household composition
    - ☐ Economic situation
    - ☐ Number and type of available *private* means of transport (car, bike etc.)
    - ☐ Walking time to the closest public transportation stop
    - ☐ Number of trips per person
    - ☐ Other: *Click here to enter text.*
19. **Please select (or add) the people attributes included in the dataset:**
    - ☐ Age
    - ☐ Gender
    - ☐ Academic level
    - ☐ Employment type
    - ☐ Working hours
    - ☐ Income
    - ☐ Living location (*Indicate here the aggregation level (postal code, district etc.)*)
    - ☐ Availability of public transport card
    - ☐ Availability and type of driving license
    - ☐ Available private means of transport
    - ☐ Total traveled distance per person
    - ☐ Total traveled time per person
    - ☐ Care of kids/relatives etc.
    - ☐ Other: *Click here to enter text.*

D. Information about the attributes for each reported trip

20. **On which aggregation level the dataset encodes the origin and destination of the reported trip?**
    - ☐ By postal code
    - ☐ By municipality
    - ☐ By district
    - ☐ Other: *Click here to enter text.*
21. **Please select (or add) the trip purpose categories included in the dataset**:

- ☐ Work
- ☐ Business trip
- ☐ School/education
- ☐ Dropping off/picking up/accompanying people
- ☐ Shopping & Errands
- ☐ Leisure Time (Sports, Theater etc.)
- ☐ Visiting friends & relatives
- ☐ Other: *Click here to enter text.*

Please describe how the survey reports trips back home: *Click here to enter text.*

Was the respondent able of picking more than one option?

- ☐ Yes
- ☐ No

22. **Please select (or add) the categories of transport means included in the dataset**:
    - ☐ Car as Driver
    - ☐ Car as Passenger
    - ☐ Motorcycle
    - ☐ Foot (Pedestrians)
    - ☐ Micromobility means (bicycle, e-bike, scooter, e-scooter)
    - ☐ Public/Regional Bus
    - ☐ Coach
    - ☐ Metro
    - ☐ Tram
    - ☐ Plane
    - ☐ Ship
    - ☐ Taxi
    - ☐ Suburban/Regional Train
    - ☐ Long Distance Train
    - ☐ Other: *Click here to enter text.*

    Was the respondent able to picking more than one option?

    - ☐ Yes
    - ☐ No

23. **Please select (or add) other attributes, related to the reported trips, included in the dataset:**
    - ☐ Length of trip
    - ☐ Duration of trip
    - ☐ Other: *Click here to enter text.*

E. Other

24. **Is any availability of built environment data that correspond to the survey area?**
    Click here to enter text.
25. **Please write any important information or detail regarding the dataset, that is not clarified in the list of questions above:**
    Click here to enter text.